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ABSTRACT

This document was designed as a resource for district-level professional developers and teacher leaders who work with middle school teachers of mathematics. A bridge between standards and the classroom, it offers opportunities for teachers to examine the interrelationships between assessment, standards, and instruction in order to improve student achievement in mathematics. This document is organized into three modules: (1) Aligning Assessment to Standards; (2) Collecting Standards-Based Evidence; and (3) Planning Instruction to Support Standards. Each module contains an overview, preparation needs, a key to the transparencies and handouts for the module, a one-page summary of key points, and facilitator notes and script. Facilitator support, supplementary activities, and selected references are also included. (Contains 18 references.) (ASK)

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Learning *from* Assessment

A MIDDLE SCHOOL MATHEMATICS PROFESSIONAL DEVELOPMENT RESOURCE

by
Tania J. Madfes and Ann Muench

SE 060 895

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NCTM

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The agency was created in 1995 to unite and enhance the capacity of Far West Laboratory and Southwest Regional Laboratory, two of the nation's original educational laboratories created by Congress in 1966. In addition to our work across the nation, WestEd serves as the U.S. Department of Education's designated Western Regional Laboratory, serving Arizona, California, Nevada, and Utah. The organization's headquarters are in San Francisco, with additional offices in Arizona, Massachusetts, Washington, DC, and elsewhere in California.

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PREFACE

Education policy is currently focused on the need for agreed–upon standards that describe what students should know and be able to do. Virtually every state has developed content standards in core curriculum areas, including mathematics. Most states have made significant progress in developing performance standards, to be used as accountability measures in high–stakes tests[1]. While policy emphasizes standards and assessment, it is up to teachers to figure out how standards should be implemented in the classroom.

Teachers and administrators need to examine the meaning of each standard, what student performance looks like when the standard is mastered, and how they would find evidence of such mastery. And most importantly, they need to think together about what needs to happen to provide students opportunities to learn and to meet the standards.

The movement to establish agreed–upon standards and, in turn, base teaching practices and school decision–making on those standards, requires that assessment systems be used in more informative ways than ever before. Data from the assessment system can serve as a resource to determine whether instructional programs reflect the agreed–upon standards. Teachers — as well as others in the educational community — need to be confident that assessment aligns with standards being implemented in their classrooms. This alignment of assessment with instruction ensures that what is taught is being tested and that what is being tested is being taught.

Public attention is usually focused on large–scale test results, but an assessment system includes much more. Classroom assessment plays a critical role in the system, and it is here that alignment of assessment with instruction is of major importance. Teachers use assessment to monitor student progress and they make instructional decisions based on the assessment data they collect.

[1] *Mathematics specialists in 23 states reported their state's mathematics assessment as based on recently completed standards. In addition, 23 other states with mathematics standards in place are developing or have plans to develop new assessments (Council of Chief State School Officers, 1997).*

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PREFACE

Currently, many professional development programs use assessment to engage teachers in deepening their own understanding of mathematics content, as well as refining their teaching practices. Groups of teachers gather to review, score, and discuss student work. These activities help focus teachers on the consequences of their teaching, as they detect discrepancies between what they believe they teach and what students appear to have learned (Driscoll and Bryant, 1998).

This project looks at assessment in a different light, by examining assessment items themselves, particularly as they relate to any given set of standards. Feedback from our field–test participants confirms that analyzing the mathematics in assessment items helps teachers make sense of standards and on their implementation in the classroom.

Translating standards into instructional practice is no easy task. Certainly attempting the task as an individual teacher would be overwhelming. Participants in *Learning from Assessment* sessions work together to clarify the meaning of standards, evaluate assessment tools in terms of their alignment to mathematics standards at the middle school level, and plan student learning experiences that reflect standards–based teaching. Thus by examining assessment through standards, teachers acquire new tools for enhancing student achievement.

ACKNOWLEDGMENTS

Creating effective professional development materials is an effort requiring a team of people with a variety of skills and knowledge. The *Learning from Assessment* development team was composed of just such a group of people. Patricia Armstrong, Elizabeth Reeves Rognier and Pamela Tyson, three people who have extraordinary facilitation skills combined with great insight about what works best with teachers, helped mold the module scripts and conducted field tests of the materials. Marianne Smith kept our communication clear and concise by posing wonderful questions as well as editing text. Adrienne (Adi) Haspel held the entire team together through her energy, thoughtfulness, and sense of humor. We were also fortunate that Adi possesses wonderful graphic design skills and an abundance of patience.

The following individuals offered useful advice and suggestions early in the process: Charles Allan, Harold Asturias, Steve Benson, Carey Bolster, Mary Kay Bouck, Carlos Cabana, Frances Curcio, Linda Dritsas, Ed Esty, Paula Evans, William J. Frascella, Judd Freeman, Jane D. Gawronski, Marieta Harris, Ann Kahn, Sharon Kallus, Michael Kestner, Miriam Leiva, Alfred Manaster, Derek Mitchell, Sue Rigney, Paul Schwarz, Dorothy Strong, and John Sutton.

The contract for this work was part of the U.S. Department of Education's Mathematics Initiative. Judy Wurtzel, Director of the Mathematics Initiative, Patricia O'Connell Ross, of OERI, and John Luczak, special assistant, provided the initial vision for the project as well as guidance throughout its development.

The *Learning from Assessment* development process involved field-testing with a diverse group of participants. Field-test participants included novice and veteran teachers from rural and urban school districts, middle school mathematics teachers involved in a county-wide mathematics project and classroom teachers with no special affiliation to a training program, professional developers from the NSF-funded Mathematics Renaissance, and county and district mathematics specialists. We thank all of these educators who provided rich discussion and thoughtful feedback on the activities, materials, and usefulness of *Learning from Assessment*. We specifically acknowledge the following groups for supporting our efforts:

Laguna Salada School District, CA
Mississippi Bend Area Education Agency, Bettendorf, IA
Sebastapol Unified School District, CA
Sonoma County Math Academy, CA
Tracy Unified School District, CA
West Contra Costa Unified School District, CA

OVERVIEW

The tool moved the participants smoothly through the concept of alignment of the intended, delivered, and achieved curriculum. The process was effective in guiding participants to new levels of understanding about alignment issues.

Professional Developer who field tested materials

I will use this experience as an incentive to really look at the standards. I have the standards book but it sits on the shelf and I don't do anything with it. This makes it all seem less threatening.

Teacher

Learning from Assessment *(LfA)* was designed as a resource for district–level professional developers and teacher leaders who work with middle school teachers of mathematics. A bridge between standards and the classroom, *LfA* offers opportunities for teachers to examine the inter–relationships between assessment, standards, and instruction in order to improve student achievement in mathematics. Items from large–scale assessments (TIMSS, NAEP, and other national projects) are used as focal points for discussing critical issues that support student learning[1]. *LfA* provides tools for examining assessment through standards to help teachers:

- Interpret and reach consensus about the meaning of specific standards.
- Choose or modify assessments aligned with local, district, or state standards.
- "Cross–map" assessments with selected standards to identify gaps and overlaps in testing of important mathematics content.
- Plan student learning experiences that reflect standards–based teaching.
- Examine instructional materials and assessments in terms of standards alignment within and across grade levels.

One assumption in creating these materials was that teachers need to understand their own local (district or state) standards before they can use them effectively. They need to engage in serious discussions with colleagues that help them reach shared interpretations of the standards that can inform instruction. The materials and tools in the *Learning from Assessment* package support this collegial process,

[1] *For more information on TIMSS and NAEP see Selected References in the Facilitator Support section.*

Everyone has a different approach and a different opinion until they sit down and really look at the standards and what they are teaching.

Teacher

Districts should find this tool to be very helpful in choosing and modifying assessments that align with their standards.

Professional Developer who field tested materials

prompting serious and deep discussions about the things that matter to teachers of mathematics. Teachers can learn to use these tools in a short period of time. Then, they can apply the approach to local standards as they design and select better assessment items and plan instruction aligned with standards.

Participant feedback from pilot and field test sessions indicates that the materials supply a missing link in the building of a coherent system of mathematics instruction (i.e., alignment of standards, instruction, and assessment). Observation and feedback also confirm that the materials, combined with the process of inquiry, open up substantive discussions of mathematics among teachers. This is the true value–added component of *Learning from Assessment*, and we take pride in providing teachers with new ways to think about mathematics content, teaching, and learning.

PROFESSIONAL DEVELOPMENT SESSIONS

The core work of *Learning from Assessment* has been organized into three modules: *Aligning Assessment to Standards*, *Collecting Standards–based Evidence*, and *Planning Instruction to Support Standards*. Each module has a unique focus and incorporates a variety of techniques that can be adapted for classroom use. Comprehensive sets of materials to be used with teachers in professional development sessions also include assessment items representing geometric and/or algebraic thinking. Additional items can be selected from the collection found in *Appendix B: Selected Assessment Items*.

OVERVIEW

It was interesting to note how each teacher interpreted the standards and how that could cause problems in your own district/schools.

Math Specialist

I learned how important it is to discuss language and terminology of the standards with teachers — what do we mean by this? Math backgrounds vary and interpretations of standards vary too.

District Coordinator

The modules are structured to investigate one or more of the following *LfA* Guiding Questions:

- **What standards does the assessment address?**
- **What mathematical thinking would our students use on the assessment?**
- **Are we assessing what we think we are assessing?**
- **How do we link the assessment to instruction?**

Each module contains the following:

Overview: Summary, Purpose, and Special Notes

Preparation: Materials to duplicate, necessary supplies and equipment, space considerations.

Key to Transparencies and Handouts for the Module: A graphic listing of materials to be reproduced, such as charts, handouts, or transparencies.

At-A-Glance: A one-page summary of key points, directions, time frames.

Facilitator Notes and Script: Detailed guidance and sample scripts for sessions, including representative participant responses.

MODULE 1: Aligning Assessment to Standards

In Module 1, participants analyze the mathematical content of an assessment item to identify which standard(s) it addresses or assesses. They then modify the item to be more tightly aligned with the identified standard(s). Discussions focus on, *What mathematical thinking would our students use on the assessment?* and *Are we assessing what we think we are assessing?*

OVERVIEW

The most useful thing I learned was the process of tying assessment to standards and how carefully it needs to be done.
Teacher

Precision in test writing helps to check if you are assessing what you wanted to assess.
Teacher

Good problems, even though they're good, may not match the standards.
Teacher

As a result of engaging in Module 1, participants will:

- become familiar with a given set of standards,
- discuss interpretations of those standards,
- develop a "critical eye" for selecting or developing assessment items, and
- learn how to align assessment to standards.

MODULE 2: Collecting Standards–based Evidence

In Module 2, participants use mathematics standards of a hypothetical school district with a group of assessment items, to answer the question, *What standards does the assessment address?* Participants also discuss: *How do we select assessment items? How do we decide which standards to emphasize in our assessments?* and *Are all standards "testable?"*

As a result of engaging in Module 2, participants will:

- look carefully at assessment tools to determine what they actually require of students,
- use standards as a guide for creating assessments,
- build an assessment framework, and
- look for gaps and overlaps in their own assessments.

MODULE 3: Planning Instruction to Support Standards

Module 3 introduces a standards–based instructional planning guide as a way to respond to the question, *How do we link the assessment to instruction?* Using this guide, participants examine sample assessment items aligned with a standard. They then determine what student

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OVERVIEW

There is more than one way to come up with the right answer. There is no guarantee that any of the concepts you think you are testing will indeed be used by the student in coming up with his/her answer.

Teacher

The most meaningful thing I learned was how to relate what I already do to a more algebraic experience for my students.

Teacher

learning experiences could lead to achievement of that specific standard. Thus the mathematics found in the assessment items and the required student learning experiences guide the process of developing a standards–based instructional plan.

As a result of engaging in Module 3, participants will:

- learn to use a standards–based instructional planning model,
- identify required learning experiences based on standards, and
- align instructional strategies and materials with identified student learning experiences.

FACILITATOR SUPPORT

Planning Tools

The *Facilitator Support* section includes several planning tools to assist you in assessing your needs and deciding how best to use *LfA* materials to meet your goals as a professional developer. We know that it is not enough to simply provide more and better professional development. In this age of accountability, students are expected to meet high standards, teachers are being held accountable for student achievement, and professional developers are being asked to show that their work is effective. We have assembled materials to help you collect evidence about the impact of your work and to chart your own progress.

In addition, we offer variations for developing each of the modules beyond its basic two–hour session. These variations can be incorporated to create a variety of sequences for a professional development series focused on mathematics assessment. Three sample sequences are presented for your consideration.

The strong connection between the intended curriculum, the delivered curriculum, and the achieved curriculum. How very sad for kids when those are not all one in the same.

Teacher

The whole process was helpful. The handout pertaining to the relationship between standards, instruction, and assessment is simple yet powerful.

Professional Developer

Supplementary Activities

Four supplementary activities are also suggested as options that can be used to extend and enhance your use of the modules.

Magnetic Words: This brief warm–up activity helps develop the interaction between participants as well as focus attention on the essential aspects of the *LfA* curricular model: Assessment, Instruction, and Standards.

Altered Assessment: In this "springboard" activity, participants review a variety of short, related assessment items and analyze the type of information each might elicit from students. By noting slight changes in context as well as content, participants learn ways that tasks can be modified to be more powerful.

Examining Resources to Support Alignment: The *LfA* materials utilize a curricular model that emphasizes alignment of standards, the instructional program, and assessment. This activity helps to identify the support and resources needed by teachers to accomplish better alignment of these elements.

***Hop To It!* Using the PBS *Mathline*® Video:** The *Hop To It!* video, part of the PBS *Mathline*® series on algebraic thinking, was created in conjunction with *LfA* Module 1. The *LfA* package includes the video and guidelines for when, why, and how you can use specific portions of it with each of the *LfA* modules.

Selected References

This section includes an annotated bibliography as well as descriptions of additional resources related to large–scale mathematics assessment.

A good tool for determining usefulness of an assessment item.
State Department of Education Math Specialist

I learned a process for meeting the standards — deciding what our students need, how we meet that need and then how our students show learning.
Teacher

APPENDIX A: TRANSPARENCIES AND HANDOUTS

All handouts and transparencies necessary for conducting sessions with teachers are included as *black line masters* (BLM). Each of these has been labeled with a BLM number. Icons of BLMs appear within the module scripts to indicate when they are to be used.

Black line masters of the National Council of Teachers of Mathematics *Curriculum and Evaluation Standards for School Mathematics, Grades 5–8* (1989) are provided for use in Module 1. Documents reflecting specific standards to be used in Modules 2 and 3 have been adapted from the *Principles and Standards for School Mathematics: Discussion Draft* (October 1998).

APPENDIX B: SELECTED ASSESSMENT ITEMS

Learning from Assessment materials include released eighth–grade items from large–scale assessments such as the Third International Mathematics and Science Study (TIMSS), the National Assessment of Educational Progress (NAEP), and other large–scale assessment projects. These items were selected to prompt in–depth discussion among teachers concerning content, instruction, and student thinking. Although materials for each *Learning from Assessment* module indicate specific assessment items to be used, as facilitator, you may wish to focus on different content categories or item types. A matrix has been designed to help you easily locate assessment items beyond those used in the modules.

OVERVIEW

The mapping activity gave a good visual of the standards that were being met or not met. The process of looking at items and standards evoked stimulating conversations.

Teacher

I will focus more on whether the experiences I offer children line up with the standards.

Teacher

Each item included in the collection has been assigned an *LfA* reference number (**I–1** through **I–28**) and has been classified according to its source, item type, and content area. There are five content categories: *Geometry, Algebraic Thinking, Patterns and Functions, Number Sense and Operations,* and *Data: Analysis and Management.* Many items cover more than one content category (e.g., *Algebraic Thinking* and *Patterns and Functions*). If an item requires the student to use problem–solving strategies and reasoning in a non–routine way, the item is also categorized as *Problem Solving.*

For information on how to access the full collection of TIMSS and NAEP released items, see the Selected References *section.*

MODULE *One*

Aligning Assessment to Standards

OVERVIEW OF MODULE 1

SUMMARY

In Module 1, participants analyze the mathematical content of an assessment item to identify which standard(s) it addresses. After modifying the item to better align it with selected standard(s), they identify student knowledge and learning experiences necessary for success on such assessments.

PURPOSE

As a result of engaging in Module 1, participants will:

- become familiar with a given set of standards;
- discuss interpretations of those standards;
- develop a "critical eye" for selecting or developing assessment items; and
- learn how to align assessment to standards.

TIME REQUIRED

Approximately 2+ hours

SPECIAL NOTES

- This session requires a set of mathematics curriculum standards for middle school. Black line masters of the 1989 National Council of Teachers of Mathematics *Curriculum and Evaluation Standards for School Mathematics* (grades 5–8) are included for this purpose.
- To customize this module, use your own district or state Standards.
- For Extension and Expansion ideas see the Facilitator Support section.

PREPARING FOR MODULE 1

MATERIALS TO PREPARE

TRANSPARENCIES

Module 1 Title Page **(BLM–1a)**
Guiding Questions **(BLM–2)**
Large–scale Assessment **(BLM–4)**
Alignment Model **(BLM–5)**
Alignment Quote **(BLM–6)**
Item 16 **(BLM–7)**
What mathematical thinking would our students use? **(BLM–8)**
What Standards does the assessment address? **(BLM–10)**
Eye Test **(BLM–11)**
Are we assessing what we think we are assessing? **(BLM–12)**
How do we link the assessment to instruction? **(BLM–13)**
What, where and when? **(BLM–14)**
Afterthoughts **(BLM–15)**

HANDOUTS

Guiding Questions/Alignment Model **(BLM–3)**
Item 16 **(I–16)** *(See Appendix B)*
Curriculum Standards cut into decks of cards (one deck per person) **(BLM–9a–e)**

LARGE WALL POSTERS

Guiding Questions **(BLM–2)**
Alignment Model **(BLM–5)**

FACILITATOR SUPPLIES AND EQUIPMENT

Overhead projector and screen
Pens for overhead
Blank transparencies
Masking tape
Chart markers and chart paper
Easels (optional but helpful)

PARTICIPANT SUPPLIES

Straight–edge
Half sheet of chart paper or newsprint
Colored markers or crayons *(at least two per person)*
Scratch paper
3x5 Post–it™ notes *(at least two per person)*

ROOM SET UP

Post charts of the *Alignment Model* and *Guiding Questions* in prominent locations so that they can be referred to throughout the session. In addition, you will need:

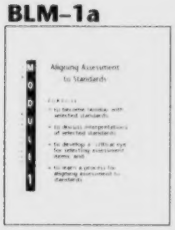
- accessible wall space for displaying participants' work;
- seating arrangement for partner and small group work; and
- traffic patterns designed to allow easy access to display area.

TRANSPARENCIES AND HANDOUTS FOR MODULE 1

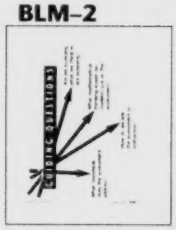
FROM APPENDIX A AND B

TRANSPARENCIES

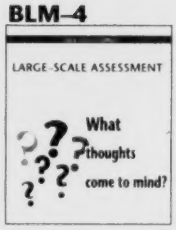
BLM–1a



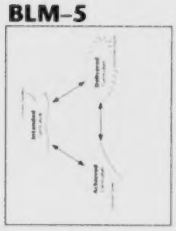
BLM–2



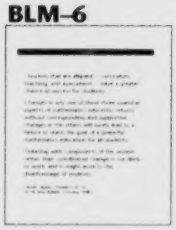
BLM–4



BLM–5



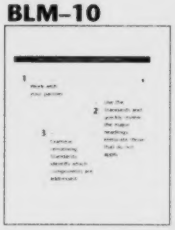
BLM–6



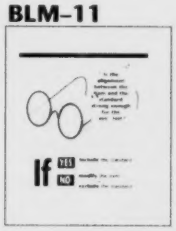
BLM–7

BLM–8

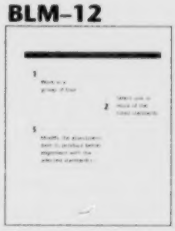
BLM–10



BLM–11



BLM–12



BLM–13

BLM–14

BLM–15

HANDOUTS

BLM–3

I–16

BLM–9a–e

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AT-A-GLANCE MODULE 1

(2 + HOURS)

A. WHAT QUESTIONS AND ASSUMPTIONS GUIDE THIS SESSION?

(15 MIN.)

- ❒ Explain how this module fits with other staff development events.
- ❒ Outline **Purposes** for this session. (BLM–1a)
- ❒ Present **Guiding Questions** as an overview of the session agenda. (BLM–2). Distribute handout. (BLM–3)
- ❒ Discuss: "**Large-scale assessment**" What comes to mind? (BLM–4)
- ❒ Introduce the **Alignment Model.** (BLM–5)
  - ☆ Discuss NCTM **alignment quote.** (BLM–6)
  - ☆ Discuss **situations** where one component is not aligned and consequences of misalignment.

B. WHAT MATHEMATICAL THINKING WOULD OUR STUDENTS USE?

(20 MIN.)

- ❒ Display **Item 16.** (BLM–7)
- ❒ Ask, **What is this item testing?** and record on chart paper or transparency.
- ❒ Have participants **do item individually** on chart paper, and post. (I–16) and (BLM–8)
- ❒ As a whole group, **share** how each solved the problem, discussing the mathematical thinking involved.

C. WHAT STANDARDS DOES THE ASSESSMENT ADDRESS?

(25 MIN.)

- ❒ Distribute **Standards.** (BLM–9a–e)
  - ☆ Have partners identify which standards Item 16 addresses. (10 min.) (BLM–10)
  - ☆ Share as whole group, record findings on **Standards Addressed** chart.

D. ARE WE ASSESSING WHAT WE THINK WE ARE ASSESSING?

(30 MIN.)

- ❒ Refer to the posted standards and Item 16. (BLM–7)
  - ☆ Discuss the strength of the relationship between the item and each of the standards, and the importance of alignment.
- ❒ Use the "**Eye**" test with each standard. (BLM–11)
  - ☆ Review each standard to determine if item needs modification to improve alignment.
- ❒ Have small groups **modify the item** to better meet the listed standards. (10 min) (BLM–12)
  - ☆ Have groups share ideas, using a clean transparency over original item.

E. HOW DO WE LINK THE ASSESSMENT TO INSTRUCTION?

(15 MIN.)

- ❒ Display Item 16, showing modifications for **algebraic thinking.** (BLM–7)
- ❒ Record on chart paper: "What **mathematical knowledge** and **vocabulary** do students need in order to attempt this item?"
- ❒ Have small groups **identify prior learning experiences.** (BLM–13)
  - ☆ Have groups record their responses on stickies, and post them on the **Learning Experiences** chart (5–7 min.)
- ❒ **Summarize** posted results, noting common ideas and missing elements.
- ❒ Have group consider everything we expect students to know and experience. (BLM–14)

F. RETRACING OUR STEPS

(5 MIN.)

- ❒ Refer to **Alignment Model** and review the major accomplishments of the module. (BLM–5)

G. REFLECTION

(10 MIN.)

- ❒ Have participants respond to prompts and share in closing discussion. (BLM–15)

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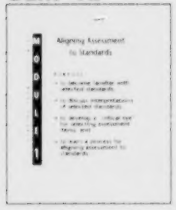
Aligning Assessment to Standards

MATERIALS AND NOTES

SAMPLE SCRIPT

A. WHAT QUESTIONS AND ASSUMPTIONS GUIDE THIS SESSION?
(15 MINUTES)

BLM–1a



Following an introductory activity, display BLM–1a to outline the purpose and agenda for this session.

BLM–2

BLM–3

Display BLM–2, refer to the large poster of the *Guiding Questions* and BLM–3, *Guiding Questions and Alignment Model.*

Using an assessment item selected from TIMSS — the Third International Mathematics and Science Study — we will explore how assessment relates to curriculum standards and instructional practice.

As we look at assessment through standards, these four questions will help to guide our discussions. We will approach the questions in this order as we analyze the assessment item:

- **What mathematical thinking would our students use on the assessment?**
- **What standards does the assessment address?**
- **Are we assessing what we think we are assessing?**
- **How do we link the assessment to instruction?**

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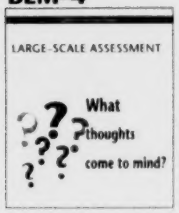
MATERIALS AND NOTES

SAMPLE SCRIPT

BLM–4



Display BLM–4 and pose a rhetorical question for individual reflection. You may ask volunteers to share their thoughts with partners or the whole group.

What comes to mind when you hear the words "large–scale assessment"?

Typically, we think of large–scale assessments as instruments to evaluate student performance — either students answer the items correctly or they don't. We rarely have the opportunity to examine the items, nor do we think much about what else these items can tell us.

We can, however, use these items to better align our *delivered curriculum* and our *intended curriculum.*

BLM–5

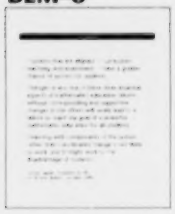
Display BLM–5, and refer to the large poster of the *Alignment Model.*

For our purposes, we are using this simplified Alignment Model to illustrate how three major components of our educational programs are related:

- **CURRICULUM STANDARDS represent what the district or the state designates as the *intended curriculum.***
- **INSTRUCTIONAL PROGRAMS consist of the written curriculum of a district (the scope and sequence), the materials used for instruction, and what teachers and students actually do in the classroom. These elements comprise the *delivered curriculum.***
- **The ASSESSMENT SYSTEM is the approach we take at the national, state, district, and classroom levels to determine what students actually know and can do. The results of the assessment represent the *achieved curriculum.***

MATERIALS AND NOTES

BLM–6



Display BLM–6, to reinforce the importance of alignment.

Provide time for partners to discuss and share examples of misalignment between intended, delivered and achieved curriculum elements. This will help to emphasize the importance of aligning all three components of the curriculum.

> *Example: In one school, classes are taught using problem–based learning techniques that are consistent with and build upon district–adopted Standards. While instruction and standards are aligned, the state test is multiple–choice and fact–based. Parents may demand some explanations if students do not do well!*

The brief discussion on alignment helps reinforce the need for examining assessment through standards.

SAMPLE SCRIPT

Systems that are aligned — standards, instruction, and assessment — have greater potential for leading to student success. Changing any one of these three essential components without corresponding, supportive changes in the other two will probably work to the disadvantage of students.

What are some situations where one of the curriculum components (intended, delivered, achieved) is not aligned with the others? What are some possible consequences of the misalignment?

Because there is such great emphasis today on Standards and Accountability, we need to be sure that our entire system is aligned. For this reason we look at assessment through standards.

MATERIALS AND NOTES **SAMPLE SCRIPT**

B. WHAT MATHEMATICAL THINKING WOULD OUR STUDENTS USE ON THE ASSESSMENT?
(20 MINUTES)

Establish a context for the next activity.

You may want to provide a simple one, such as: "You are putting together some tests for your classes and a colleague has given you some items from TIMSS." Another scenario might be, "You have been asked to help develop the district middle school mathematics assessment. Your committee is reviewing a collection of items from recent large–scale assessments, such as TIMSS and NAEP."

BLM–7

Display BLM–7 and have participants brainstorm what they think the item is testing. No discussion is necessary at this point.

The purpose of the brainstorm is to focus attention on the item. Later, you will be able to comment about the difference between "taking a quick look" and "analyzing the item for content and alignment with standards."

If you were quickly leafing through a stack of potential assessment items and saw this item — number 16 — what mathematics would you think it is testing?

Record the responses on chart paper or transparency titled: "What is this item testing?"

Possible responses: geometry, patterns, using a table.

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MATERIALS AND NOTES

I–16

BLM–8

Distribute copies of Item 16 (I–16).

Display BLM–8 as you provide the instructions. Indicate where posters are to be displayed.

Allow approximately 10 minutes for completing the task and posting the work.

Invite participants to a gallery walk so they can see the variety of strategies used. If there is not adequate wall space to display posters, have work displayed on tables and conduct a walk–about. Ask participants to explain their mathematical thinking.

Although the work may appear similar, strategies often differ; probe for clarification. If a variety of strategies are not shown, offer one of your own or adapt one of the sample papers (see ***page 1–17****). Strategies may include: extending the triangles and counting up to the eighth figure; filling in the chart and either recognizing squares or addition of consecutive odd numbers as the pattern; extending the chart to the eighth figure; or recognizing fig.1 is a 1×1, fig.2 is 2×2, etc. and extending that pattern to find fig.8 is 8×8 or 64. A discussion about the assumptions used to do the problem may be an extremely useful segue to the next section.*

SAMPLE SCRIPT

Let's take a closer look at the item and see what is actually involved in working on it. Think about how you would expect most 8th graders to respond to the item.

Use the chart paper and markers to make a poster that shows one method for doing the item. When you have completed your poster, display your work and try to cluster it with others showing similar strategies.

MATERIALS AND NOTES | **SAMPLE SCRIPT**

C. WHAT STANDARDS DOES THE ASSESSMENT ADDRESS?

(25 MINUTES)

Once participants are familiar with the mathematics involved in the assessment item, they are ready to explore alignment with standards.

BLM–9a–e

Distribute sets of Curriculum Standards BLM–9, or your own district standards.

Display BLM–10 on overhead.

If you are using the NCTM Standards *and time is a factor, you may limit the activity by asking participants to focus only on the Content Standards (#5–13).*

BLM–10

Allow approximately 10 minutes for this task. Provide a time check as participants work. Remind them to work in pairs, although initially they will need some time to study the materials individually.

Set up chart labeled *Standards Addressed.*

Share the findings as a whole group.

It is important that the standards be publicly displayed. Recording them may take considerable time; ask two volunteers to record and take turns writing out the identified standards. You may find it useful to duplicate the set of standards on sentence strips and ask two participants to help post the appropriate strips as the standards are identified.

As you facilitate, ask participants to reference displayed work and explain their thinking.

Considering the mathematics involved in this item, what STANDARDS is it addressing?

Here is a set of Curriculum Standards to use in answering this question.

Your task is to work with a partner to identify the individual standards you think this item is addressing. A good way to start the process is to look through the major headings and eliminate any you think do not apply. Next, examine the remaining standards and decide which components are addressed.

During your analysis, refer to the posted work to support your thinking.

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MATERIALS AND NOTES

SAMPLE SCRIPT

D. ARE WE ASSESSING WHAT WE THINK WE ARE ASSESSING?

(30 MINUTES)

Although an assessment item may address many standards, it might not actually assess whether a student meets those standards. The purpose of the following activity is to analyze and modify the item so that it not only addresses a standard but can be used to assess it.

BLM–7

Refer to all of the posted standards and BLM–7.

We know that evidence should be collected from more than one item to substantiate a student's mastery of a standard. It is still important, however, that each item used in an assessment be strong enough to provide evidence of mastery.

These are the standards that this item from TIMSS may be addressing. But how strong is the relationship between the item and each of these standards? Is the alignment strong enough to produce evidence that a student who has correctly answered the question meets that standard?

Ask participants why every assessment item needs to be tightly aligned to one or more standards.

Possible response: The District requires students to successfully answer two out of three items for each district Standard for promotion to the next grade.

Why should every item in an assessment be tightly aligned with one or more standards?

BLM–11

Display BLM–11 to illustrate the point and convey instructions.

Let's look at each standard listed and see if the alignment can meet the "eye" test.

The "eye" test asks, does a student's response to the assessment item provide you with evidence to:

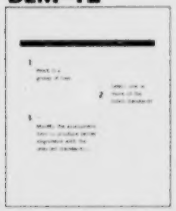
a. look a parent in the eye and say that this child has met or not met the standard?

MATERIALS AND NOTES

Review the entire list of standards with the whole group. If the relationship between the item and a standard/component is already strong, leave it as is. If the item needs to be modified to produce a stronger alignment, circle the Standard/component. If the relationship is weak, cross it out.

Note: It is likely that most will either be eliminated or require item modification.

BLM–12



After identifying specific standards as having potential for strong alignment with the item, display BLM–12.

Allow 10 minutes for groups to modify the item.

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SAMPLE SCRIPT

or

b. look your colleague (the next mathematics teacher) in the eye and say the student has met the standard?

If the answer to these questions is YES, then we will list the standard as one the item could be used to assess.

If the answer is NO, then we have two choices: we can either exclude the standard from the list OR we can modify the item to meet the standard.

Let's look at each of the standards that remain and consider how we could modify the assessment item to generate strong evidence of a student's mastery of that standard.

Working in a group of four, select one or more of the listed standards and discuss what modifications you would make to the item to produce stronger alignment.

Prepare to present your new item (to the whole group) explaining what changes you made and why you made the particular alterations.

MATERIALS AND NOTES

SAMPLE SCRIPT

BLM–7

Using a fresh transparency over the original BLM–7, ask a group representative to show their modification. Presenters should explain which standards are being assessed and justify their changes. Highlight the similarities and differences from group to group.

If one or more of the posted standards has not been assessed, discuss why it was not, whether it should be, and how it could best be assessed.

The emphasis on algebraic thinking is important to the upcoming activity; therefore, be sure to ask which specific algebraic thinking standards the item might assess and how to modify the item to best reflect these standards.

Possible response: "How many triangles would there be in the nth figure?"

E. HOW DO WE LINK THE ASSESSMENT TO INSTRUCTION?

(15 MINUTES)

BLM–7

Display BLM–7 with modifications for algebraic thinking.

For a tightly aligned system, we must not only select standards and design assessments aligned to those standards, but identify required student learning experiences and plan instruction to provide those learning experiences.

By modifying an item to better align it to identified standards, we can be more confident that we would assess what we think we are assessing.

Suppose we want to assess algebraic thinking by using a modified version of Item 16. Let's consider the assumptions we would make about what students know and can do.

MATERIALS AND NOTES

Using a brainstorming technique, generate a list of vocabulary and concepts. Record on chart paper titled *Knowledge and Vocabulary.*

BLM–13

Display BLM–13. Have participants work in small groups to identify and discuss the learning experiences required for student success. Be sure groups focus on the types of experiences students need, rather than specific classroom activities.

(e.g., "Students have experience with a variety of visual and numerical patterns and sequences" rather than "Students need to use pattern blocks.")

Provide Post-its™ for recording responses. Set up a chart labeled *Learning Experiences* for posting responses.

Allow 5 to 7 minutes for this discussion.

Read aloud and summarize the posted responses, identifying common ideas as well as missing elements. *(e.g., "Five groups listed making tables," "I noticed that no one mentioned working with square numbers.")*

Possible responses: recording data, making tables, analyzing patterns, generating rules, dealing with extraneous information.

SAMPLE SCRIPT

What mathematical knowledge and vocabulary do students need in order to attempt the item?

In addition to the mathematical knowledge and vocabulary we just identified, think about the prior learning experiences students should have to attempt this item. What *student learning experiences* would provide the opportunities for students to learn those specific content or skills? What should *students* actually do within the *Delivered Curriculum?*

MATERIALS AND NOTES

SAMPLE SCRIPT

BLM–14

Display BLM–14.

Look at everything we expect students to know and experience before attempting this item as an assessment.

- **Can all of this be accomplished in the 8th grade?**
- **What can be done prior to 8th grade?**
- **What should this look like at various grades?**

If you plan to facilitate Module 3, indicate that the focus will be on aligning assessment and instruction.

Refer to Module 1 Extension and Expansion Ideas in the Facilitator Support section.

With more time, we can discuss the answers to these questions and think about their implications for our *instructional practices.* We must determine how we, as *teachers,* should deliver the curriculum — what strategies or materials can we use to provide those necessary student learning experiences?

F. RETRACING OUR STEPS
(5 MINUTES)

BLM–5

Refer to the appropriate parts of the *Alignment Model* during this summary.

In summary, we have accomplished a great deal in this session.

- **We analyzed an assessment item — from its initial face value to the mathematical thinking required to work on it — to determine if it was a good indicator of our achieved curriculum.**
- **We viewed the item through the lens of standards and generated a list of potential standards the item might address.**

MATERIALS AND NOTES

SAMPLE SCRIPT

- **We then aligned the item with selected standards — our intended curriculum — by modifying the item, so we could have confidence in the evidence it provides.**

- **We briefly reviewed the implications for our instructional program — the delivered curriculum — taking into consideration the knowledge, vocabulary, and student experiences needed for success.**

G. REFLECTION
(10 MINUTES)

BLM–15

For feedback purposes, ask one or more reflection questions, such as those provided on BLM–15. Allow participants a few minutes to jot down their responses. Conclude with group sharing and a discussion of "next steps." This could lead to action plans for individuals, as well as plans for the group as a whole.

Now that you have been part of this process, take a few moments to think about your responses to the following prompt(s):

- ***Something I am thinking about differently is...***

- ***Because of what I learned today, something I will do differently is...***

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SAMPLE RESPONSE 1

1 triangle high
— area of 1

2 triangles high
— area of 4
(1 + 3)

3 triangles high
— area of 9
(1 + 3 + 5)

8 triangles high, so area of 64

1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 = 64!

SAMPLE RESPONSE 2

Figure	Number of Triangles	
1	1	
2	4	> 3
3	9	> 5
4	16	> 7
5	25	> 9
6	36	> 11
7	49	> 13
8	64	> 15
9	81	> 17
	100	> 19

n = figure
Number of Triangles = n^2
Sequence follows a pattern of squared numbers (Pattern Recognition)

SAMPLE RESPONSE 3

NOTE: Barriers to student success on the item are often incorporated in participant posters. For example, one teacher wrote:

My students would struggle with this. They would have more questions than answers:

What is a small triangle?
What does "congruent" mean?

They might complete the chart in this way:

a.)

Figure	Number of Small Triangles
1	1
2	4 or 5
3	11 or 12
	9 or 10

b.)

*In response to part **b.**) my students might ask:*

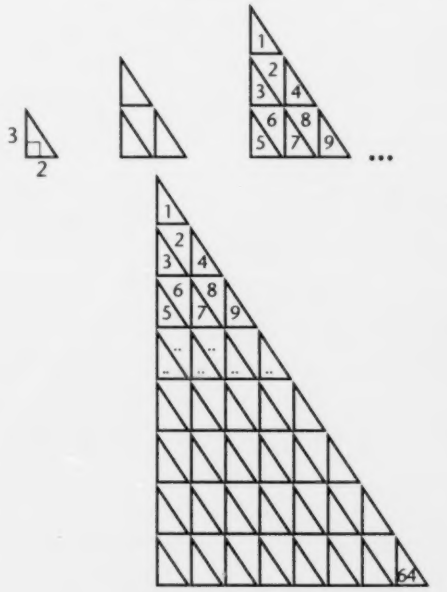
What is Figure 8?
Where is Figure 8?
What does "sequence of similar triangles" mean?

My students might also be confused by the small 2 and 3 alongside the first triangle. They would expect to use these numbers.

SAMPLE RESPONSE 4

Figure	Number of Triangles
1	1 (1 + 0)
2	4 (1 + 3)
3	9 (4 + 5)
4	16 (9 + 7)
5	25 (16 + 9)
6	36 (25 + 11)
7	49 (36 + 13)
8	**64** (36 + 13)

SAMPLE RESPONSE 5



MODULE *Two*

Collecting Standards–based Evidence

OVERVIEW OF MODULE 2

Geometric or Algebraic Thinking Options

SUMMARY

In Module 2, participants use mathematics standards of a hypothetical school district and a group of assessment items to answer the question: *What standards does the assessment address?* They complete a Standards/Assessment Matrix for use in deciding whether there are sufficient as well as appropriate assessment items for gathering evidence about student achievement. As decisions about inclusion of items are made, participants also consider factors such as the need for multiple measures and variation of item types, as well as levels of item difficulty. These activities lead to the development of an assessment framework specifying the number, type, and content of potential assessment questions as well as the nature, content, and extent of the assessment as a whole.

PURPOSE

As a result of engaging in Module 2, participants will:

- look carefully at assessment tools to determine what they actually ask of students;
- use standards as a guide for creating assessments;
- build an assessment framework; and
- look for gaps and overlaps in their own assessments.

TIME REQUIRED

Approximately 2+ hours

SPECIAL NOTES

- Materials provided allow you to design workshops that focus on either geometric ***or*** algebraic thinking.
- The Standards/Assessment Matrix should be enlarged from the original black line master so that several small Post–it™ notes are able to fit within each cell of the matrix. This matrix needs to be displayed so that everyone can see it and use it.
- To customize this module, use your own district or state Standards.
- For Extension and Expansion ideas see the Facilitator Support section.

PREPARING FOR MODULE 2

Geometric or Algebraic Thinking Options

MATERIALS TO PREPARE

TRANSPARENCIES

Module 2 Title Page **(BLM–1b)**
Guiding Questions **(BLM–2)**
Large-scale Assessment **(BLM–4)**
Alignment Model **(BLM–5)**
Alignment Quote **(BLM–6)**
***Standard:** Geometric* **(BLM–16)** *or Algebraic Thinking* **(BLM–17)**
What mathematical thinking would our students use? **(BLM–18)**
***Item:** Geometric* **(BLM–21)** *or Algebraic Thinking* **(BLM–22)**
***Standards/Assessment Matrix Chart:** Geometric* **(BLM–35)** *or Algebraic Thinking* **(BLM–36)**
What Standards does the assessment address? **(BLM–25)**
Are we assessing what we think we are assessing? **(BLM–26)**
Eye Test **(BLM–11)**
Item Selection Questions **(BLM–27)**
Afterthoughts **(BLM–15)**

HANDOUTS

Guiding Questions/Alignment Model **(BLM–3)**
***Item Set:** Geometric* **(BLM–19a–d)** *or Algebraic Thinking* **(BLM–20a–c)**
***Standard:** Geometric* **(BLM–23)** *or Algebraic Thinking* **(BLM–24)**

LARGE WALL POSTERS

Guiding Questions **(BLM–2)**
Alignment Model **(BLM–5)**
Standards/Assessment Matrix large enough to hold several small Post-itTM notes in one cell **(BLM–35)** *or* **(BLM–36)**

FACILITATOR SUPPLIES AND EQUIPMENT

Overhead projector and screen	Masking tape
Pens for overhead	Chart markers and chart paper
Blank transparencies	Easels (optional but helpful)

PARTICIPANT SUPPLIES

Scratch paper
1.5x2 Post-it™ notes *(one pad per group; different color per group)*

ROOM SETUP

Post charts of the *Alignment Model* and *Guiding Questions* in prominent locations so that they can be referred to throughout the session. In addition, you will need:

- accessible wall space for displaying participants' work;
- seating arrangement for partner and small group work; and
- traffic patterns designed to allow easy access to display area.

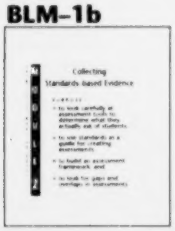
TRANSPARENCIES AND HANDOUTS FOR MODULE 2

Geometric or Algebraic Thinking Options

FROM APPENDIX A

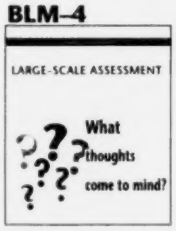
TRANSPARENCIES

BLM–1b

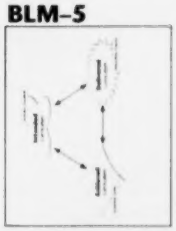


BLM–2

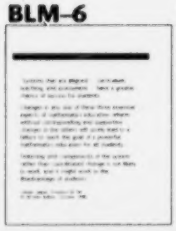
BLM–4



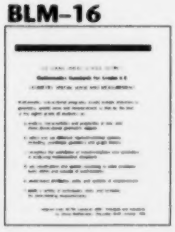
BLM–5



BLM–6

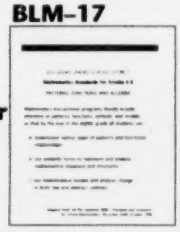


BLM–16

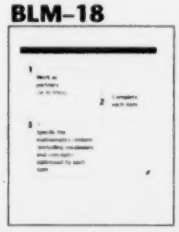


or

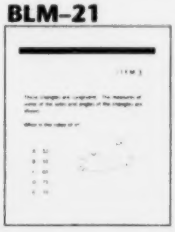
BLM–17



BLM–18

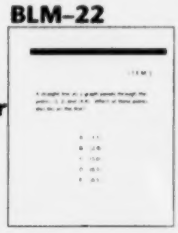


BLM–21

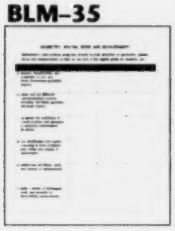


or

BLM–22

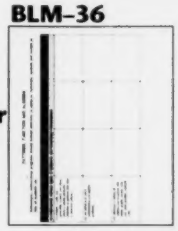


BLM–35

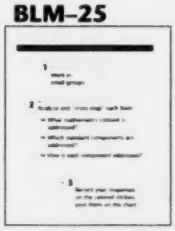


or

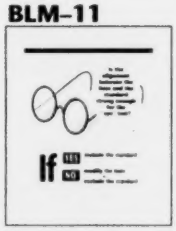
BLM–36



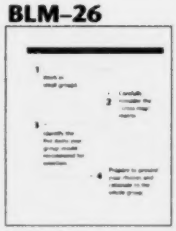
BLM–25



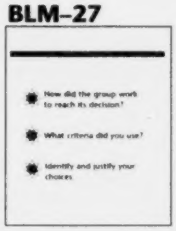
BLM–11



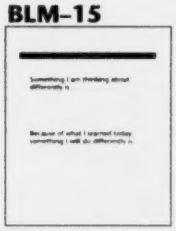
BLM–26



BLM–27



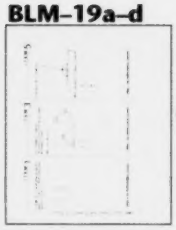
BLM–15



HANDOUTS

BLM–3

BLM–19a–d



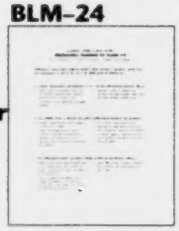
or

BLM–20a–c

BLM–23

or

BLM–24



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AT-A-GLANCE MODULE 2

Geometric or Algebraic Thinking Options (2+ HOURS)

A. WHAT QUESTIONS AND ASSUMPTIONS GUIDE THIS SESSION? (8–12 MIN.)

- ❒ Explain how this module fits with other staff development events.
- ❒ Outline **Purposes** for this session. (BLM–1b)
- ❒ Pose **rhetorical questions**, How do we know we are collecting appropriate and sufficient evidence to say our students meet our standards?
- ❒ Review **Guiding Questions** as an overview of the session agenda. (BLM–2) and (BLM–3)
- ❒ Discuss: **"Large-scale assessment"** What comes to mind?(BLM–4)
- ❒ Review (Introduce) recent ideas about the **Alignment Model.** (BLM–5) and (BLM–3)
  - Discuss NCTM **alignment quote.** (BLM–6)
  - Discuss **situations** where one component is not aligned and consequences of misalignment.

Omit or review if participants have previously engaged in these activities.

B. WHAT MATHEMATICAL THINKING WOULD STUDENTS USE ON THE ASSESSMENT? (15–20 MIN.)

- ❒ Provide a **context** using the Euclidean School District scenario working with released test items to find items that address a certain standard.
- ❒ Display the **Standard** (Geometric or Algebraic Thinking). (BLM–16 OR BLM–17)
- ❒ Display instructions for partner work. (BLM–18)
- ❒ Distribute handout of items. (BLM–19a OR BLM–20a)
  - ☆ Have pairs solve each item and identify its **mathematical content.**
- ❒ Have whole group consider **sample item** (#3 or #1). (BLM–21 OR BLM–22)
  - ☆ Discuss its **mathematical content** and record the responses on chart paper.

C. WHAT STANDARDS DOES THE ASSESSMENT ADDRESS? — PART 1 (25–35 MIN.)

- ❒ Refer to **Alignment Model** and discuss, What standards are addressed? How well do items match the standards? Do these items produce enough evidence?
- ❒ Distribute Standard (BLM–23 OR BLM–24), leaving Item transparency on overhead. (BLM–16 OR BLM–17)
  - ☆ Have partners identify which standard components are addressed and determine how they are addressed.
  - ☆ Share ideas with whole group and record on chart paper.
- ❒ Display the **Standards/Assessment Matrix**. (BLM–35 OR BLM–36)
  - ☆ Model the cross-mapping process for sample item (#3 or #1) on the transparency and on the chart with Post-it™ notes.
- ❒ Have small groups cross-map other two items. (BLM–25)

D. ARE WE ASSESSING WHAT WE THINK WE ARE ASSESSING? — PART 1 (10–15 MIN.)

- ❒ Review matrix with whole group and discuss rationale for classifications.
- ❒ Display the **"Eye"** test and share criteria for degree of alignment. (BLM–11)
  - ☆ Based on criteria, remove or move any Post-it™ notes, as appropriate.
- ❒ Analyze matrix for **Gaps** and **Overlaps**.

E. WHAT STANDARDS DOES THE ASSESSMENT ADDRESS? — PART 2 (25–35 MIN.)

- ❒ Assign additional items to groups for cross-mapping. (BLM–25)
- ❒ With whole group, review the matrix for discrepancies, gaps and overlaps.

F. ARE WE ASSESSING WHAT WE THINK WE ARE ASSESSING? — PART 2 (15–20 MIN.)

- ❒ Continue with scenario. Display instruction for choosing a few items. (BLM–26)
  - ☆ Allow 1 minute per group to report how they reached consensus and describe the criteria they used. (BLM–27)
- ❒ Review choices with whole group, and look for agreement.

G. RETRACING OUR STEPS (5–10 MIN.)

- ❒ Pose summarizing questions, including whether or not there is enough evidence and if it's the right evidence.

H. REFLECTION (10 MIN.)

- ❒ Have participants respond to prompts and share in closing discussion. (BLM–15)

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Collecting Standards-based Evidence

Geometric or Algebraic Thinking Options

MATERIALS AND NOTES

SAMPLE SCRIPT

If you have completed other *LfA* modules with the same group, ask participants to share any actions they may have taken as a result of these sessions. This discussion will serve as a review and help to set the stage for this session. Rather than re-introduce the alignment model as proposed in the script, you may want to briefly review the model and ask participants to share any recent examples of non-alignment which may have come to their attention. Then describe how this session relates to the previous one and why it is important.

A. WHAT QUESTIONS AND ASSUMPTIONS GUIDE THIS SESSION?

(8–12 MINUTES)

Following an introductory activity, explain how this module fits in with your other professional development efforts, including other modules in this *Learning from Assessment* series.

In education today, great emphasis is being placed on Standards and Accountability. Parents and the public–at–large are seeking information about student achievement. They want to know how students are doing, how their performance ranks in comparison with others, and whether Standards are being met.

MATERIALS AND NOTES

BLM–1b

Display BLM–1b to outline the purposes and set the agenda for this session.

BLM–2

Display BLM–2 and refer to the large poster of the *Guiding Questions*. Outline the session, using the *Guiding Questions* as an agenda, briefly describing the experiences participants can anticipate.

While the key question How do we link the assessment to instruction? *is not part of Module 2, it is a major focus in Module 3 and a natural extension to be considered in Next Steps.*

SAMPLE SCRIPT

As educators, how do we know we are really collecting appropriate and sufficient evidence to document that our students do meet our Standards? Is our evidence really Standards–based? Do we have enough evidence? Do we have the right evidence?

To help answer these questions, we will use a set of eighth–grade assessment items selected from large–scale projects, such as TIMSS (the Third International Mathematics and Science Study) and NAEP (National Assessment of Educational Progress).

We will analyze the items based on their alignment to a set of mathematics standards, creating an assessment matrix to be used as a decision–making tool.

As we look at assessment through standards, certain questions help guide our discussions. Today we will approach the questions in this order:

- **What mathematical thinking would our students use on the assessment?**
- **What Standards does the assessment address?**
- **Are we assessing what we think we are assessing?**

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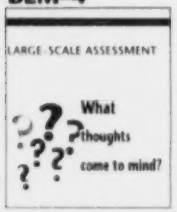
MATERIALS AND NOTES

BLM–4



Display BLM–4 and pose the rhetorical question about assessment for individual reflection. Allow a few moments as participants share their thoughts with partners or the group.

BLM–5

BLM–3

Display BLM–5 and refer to the large poster of the *Alignment Model;* and distribute BLM–3, *Guiding Questions and Alignment Model.*

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SAMPLE SCRIPT

Earlier I mentioned we would be using items released from several large–scale assessment projects. What comes to mind when you hear the words *large–scale assessment*?

Typically, we think of large–scale assessments as instruments to evaluate student performance — either students answer the items correctly or they don't. We rarely have the opportunity to examine the items, nor to consider how these items can help us in our own classroom work.

We can, however, use these items to better align our *delivered* and our *intended* curriculum by focusing on our *achieved* curriculum.

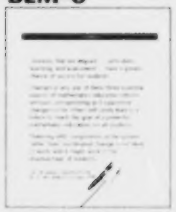
For our purposes, we are using this simplified Alignment Model to illustrate how three major components of our educational programs are related:

- **CURRICULUM STANDARDS represent what the district or the state designates as the *intended curriculum.***
- **INSTRUCTIONAL PROGRAMS consist of the written curriculum of a district (the scope and sequence), the materials used for instruction, and what teachers and students actually do in the classroom. These elements comprise the *delivered curriculum.***
- **The ASSESSMENT SYSTEM is the approach we take at the national, state, district, and classroom levels to determine what students actually know and can do. The results of the assessment represent the *achieved curriculum.***

MATERIALS AND NOTES

SAMPLE SCRIPT

BLM–6



Display BLM–6 to reinforce the importance of alignment.

Systems that are aligned — Standards, Instruction, and Assessment — have greater potential for leading to student success. Changing any one of these three essential components without corresponding, supportive changes in the other two will probably work to the disadvantage of students.

Provide time for partners to discuss and share examples of misalignment between intended, delivered and achieved curriculum elements. This will help to emphasize the importance of aligning all three components of the curriculum.

What are some situations in which one of the curriculum components (intended, delivered, achieved) is not aligned with the others? What are some possible consequences of the misalignment?

Example: In one school, classes are taught using problem–based learning techniques that are consistent with and build upon district–adopted Standards. While instruction and standards are aligned, the state test is multiple–choice and fact–based. Parents may demand some explanations if students do not do well!

A brief discussion on alignment helps reinforce the need for examining assessment through Standards.

Because there is such great emphasis today on Standards and Accountability, we need to ensure that our entire system is aligned. For this reason, we examine assessment through Standards.

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REMINDER: The following Facilitator Notes & Script provide both a Geometric and an Algebraic Thinking focus. Select the focus that best meets the needs of your group. To customize this module, use your own Standards related to the sample set of items. You may also replace or extend the set of items with those from your own assessments.

B. WHAT MATHEMATICAL THINKING WOULD OUR STUDENTS USE ON THE ASSESSMENT?

LEARNING THE CROSS–MAPPING PROCESS

(15–20 MINUTES)

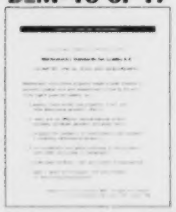
Establish a context for the next activity.

Imagine we are teachers and administrators in the Euclidean Unified School District...

As members of the district's assessment committee, we are in the process of reviewing and revising items that indicate whether or not our students have met important Standards.

We want to collect enough evidence through our assessments to be sure our Standards are sufficiently and appropriately addressed.

BLM–16 or 17



Display Standard.
(*Geometric:* BLM–16 or *Algebraic:* BLM–17)

Today we are in search of items that address the components of the district's Geometry, Spatial Sense, and Measurement Standard [Patterns, Functions, and Algebra Standard].

A set of items released from TIMSS and NAEP might be useful for assessing important mathematics. Let's start by looking at these three items.

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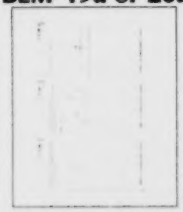
MATERIALS AND NOTES

SAMPLE SCRIPT

BLM–18 **BLM–19a or 20a**



Display BLM–18.
Distribute BLM–19a *(Geometric)* OR BLM–20a *(Algebraic)* with the first three items.

With a partner (or in trios) work on the items. For each item, identify the mathematics content (including vocabulary and concepts) the item addresses. Focus on this critical question: *What mathematical thinking would our students use on the assessment?*

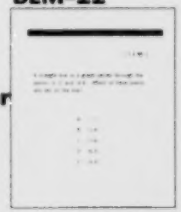
Allow approximately 10 to 15 minutes for participants to work on the problems. *(The algebraic items take less time.)*

Remind participants that their task is to concentrate on what mathematics is addressed by each item.

NOTE: In the upcoming activity, participants begin to establish criteria for deciding whether or not an item assesses or addresses a standard. This analysis sets the stage for important discussions regarding the potential for alignment of test items with standards as well as how tightly items must/can be aligned with standards.

BLM–21 **BLM–22**

or



Direct attention to Item 3 *(Geometric)* BLM–21 OR Item 1 *(Algebraic)* BLM–22.

As a whole group, discuss what content the item addresses. Record responses on chart paper.

How might students approach solving this problem?

What is the mathematics content (concepts and vocabulary) students must know? What must they be able to do?

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MATERIALS AND NOTES

SAMPLE SCRIPT

C. WHAT STANDARDS DOES THE ASSESSMENT ADDRESS? — Part 1

(25–35 MINUTES)

Direct attention to the *Alignment Model*, focusing on the valued standards (*intended* curriculum). Indicate that we will now explore the Guiding Question: *What standards does the assessment address?*

BLM–23 **BLM–24**

or

Distribute handout BLM–23 *(Geometric)* OR BLM–24 *(Algebraic)* which displays the standard in detail.

Leave the item transparency displayed.

Allow 2 to 3 minutes for participants to become familiar with the standards. Direct attention again to Item 3 *(Geometric)* or Item 1 *(Algebraic)*.

As assessment selection committee members, we are concerned not only with the content but with questions such as:

- **What standards do the items address?**
- **How well do the items match our standards based upon the mathematics content and mathematical thinking required of students?**
- **And finally, do these items produce enough evidence to show whether or not our students are meeting the standards?**

To answer these questions, we must decide which components of the standard each item addresses.

Take a few minutes to become familiar with the more detailed version of the standard. Think about what components are being addressed by this item.

Read through the major component headings, then discuss with your partner(s) which sub–components are addressed by this item.

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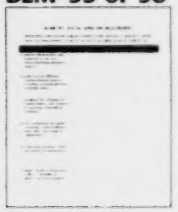
MATERIALS AND NOTES

SAMPLE SCRIPT

BLM–35 or 36



While participants are engaged in this activity, post the first part of the Standards/Assessment Matrix BLM–35 OR BLM–36 (which includes the first three items). Be sure you have enlarged the matrix so that several 1.5x2 Post–it™ notes will fit in a cell.

As a whole group, identify *How* the components are addressed. Go beyond a simple check mark, and describe with a verb, such as: *c3 — understand concepts of congruence using transformation.*

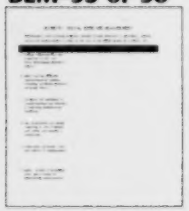
Refer to **pages 2–21** to **2–24** for specific examples.

In looking at the standards in relation to this item, what components are addressed?

How are they addressed?

*It is possible that a discussion may arise about the differences between an item **testing** a standard, **measuring** a standard, **addressing** a standard, or **touching on** a standard. A group decision may be needed about whether to loosely or more tightly relate items to standards.*

BLM–35 or 36



Direct attention to the Standards/Assessment Matrix you have posted and to the information you have just recorded.

Model how the Post–it™ notes will be placed on the matrix either by using Post–it™ notes on the chart or displaying a transparency of the chart (BLM–35 OR BLM–36) and indicating where the Post–it™ notes would be placed.

We are going to use a Standards/Assessment Matrix as a tool to help us identify the most appropriate assessment items to use with our students.

We will post our analysis about how this item either addresses or assesses components of our standards on the matrix. In this way, we can "cross–map" the items with the standards.

We will then use the resulting matrix to help us identify which items we think best meet our criteria.

MATERIALS AND NOTES

SAMPLE SCRIPT

Allow 15–20 minutes for the following:

BLM–25

Display BLM–25.

Have pairs/trios join with others to form small groups of four to six.

Distribute different–colored Post–it™ pads to each small group.

As participants work, remind them that they should: a) reach consensus in their group, and b) specify on the Post–it™ note how the Standard is addressed by the item.

Working in small groups, "cross–map" items 1 and 5 *(Geometric)* [items 2 and 5 (Algebraic)].

Identify the mathematics involved. Cite each component of the Standard the item addresses, and specify how it is addressed. Record this information on a Post–it™ note and place the notes on the matrix in the appropriate cell. Use a separate Post–it™ note for each component you identify.

D. ARE WE ASSESSING WHAT WE THINK WE ARE ASSESSING? — Part 1

(10–15 MINUTES)

Direct attention to the *Alignment Model*, reminding participants that assessment items (*achieved* curriculum) should be aligned with the valued Standards (*intended* curriculum). Indicate that we will now explore the Guiding Question: *Are we assessing what we think we are assessing?*

If convenient, have everyone gather around the matrix.

As a whole group, review the chart, noting similarities and differences in the content identified and in how groups cross–mapped the items.

Ask groups to discuss the rationale of their classifications as time permits.

Let's see what we have so far.

MATERIALS AND NOTES

BLM–11

Display BLM–11 and discuss criteria for determining how tightly aligned items should be to the standards. Record ideas on chart paper for future reference.

For this activity, participants may decide a "loose" alignment is sufficient, such that an item may address a standard/component without necessarily assessing it.

Briefly discuss the importance of agreeing on what an item does and does not address, though for this exercise we may not reach consensus. Based on their criteria, ask if any Post–it™ notes should be removed from the matrix (i.e., the item does not meet that standard according to the criteria). Review the matrix entries and revise accordingly.

Have participants analyze the matrix, describing what it shows about "GAPs" *(Standard/components not addressed)* and "OVERLAPs" *(Standard/component addressed by more than one item)*.

SAMPLE SCRIPT

What criteria do we use to decide if we have enough evidence and if we have the right evidence?

Do we have enough evidence to look someone in the eye and assure him/her that we are assessing what we think we are assessing?

We need strong evidence to meet the "eye test" — enough information to assure parents we have evidence that standards are met or not met, and strong enough to tell the next teacher a student is prepared.

Based upon the "eye test", do you want to make any changes in what has been posted?

Suppose the Euclidean committee agrees on these entries for the matrix. What can we learn so far?

What do we have?

There may be "GAPs" and "OVERLAPs" within each component as well as across cells.

What do we do next?

We may fill gaps by modifying these items (as was done in Module 1) or by selecting additional items.

Right now, we will look at some additional items.

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E. WHAT STANDARDS DOES THE ASSESSMENT ADDRESS? — Part 2

(25–35 MINUTES)

BLM–25

Display BLM–25 again.

Distribute the remaining items (BLM–19b–d for *Geometric* OR BLM–20b–c for *Algebraic).* Assign each group 2 to 3 of these items. Some items may be analyzed by more than one group, depending upon the number of groups, the number of items to be analyzed, the time available, and so on. Extend the matrix by adding blank sheets and creating columns for each item to be analyzed.

BLM–19b–d

or

BLM–20b–c

With your group, analyze your assigned items, identifying the mathematics content along with which Standards each addresses (down to the subcomponent level). Repeat the cross–mapping process and place the Post–it™ notes on the matrix in the appropriate cells.

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MATERIALS AND NOTES

Allow about 10 minutes to review the matrix as a whole group.

Discuss any discrepancies in items that were analyzed by more than one group. For example, if two groups analyzed item 7 and had different ideas about which standard components were being addressed, ask the two groups to revisit the item and try to reach consensus.

Identify GAPs and OVERLAPs, pointing out the importance of specifying the details in deciding whether or not a standard is addressed in more than one way or if a subcomponent is addressed several times. For example, if the matrix displays several items with Post-it™ notes for a certain component, are the responses referring to different aspects of the component *(e.g., item x addresses b–2 and b–3; item y addresses b–1; and item z addresses b–4)* or, are the same aspects of the component identified *(e.g., all address b–4)*?

SAMPLE SCRIPT

What are some things we notice from this cross–mapping display?

F. ARE WE ASSESSING WHAT WE THINK WE ARE ASSESSING? — Part 2

(15–20 MINUTES)

Direct attention to the *Alignment Model*, focusing on the valued Standards (the *intended* curriculum). Indicate that we will continue to explore the Guiding Question: *Are we assessing what we think we are assessing?*

Continue with the scenario:

As members on the assessment selection committee, we have some decisions to make. The matrix shows 12 geometric [9 algebraic] items cross–mapped to the standard. Now, suppose the district wants 5 of these large–scale items on the assessment, for comparing district results with international and other state standings as well as for testing our students on our own standards.

BLM–26

Display BLM–26.

Have participants resume working as groups.

Allow 10 minutes for deliberations.

If only 5 items will be used, which would you choose? Why? Work with your group. You might want to refer to the Standards/Assessment Matrix to examine the details.

Identify a group spokesperson to summarize how your group worked to reach its decisions and describe the criteria you used.

When you have reached consensus, show your choices by placing a Post–it™ note under each of the items on the bottom of the chart.

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MATERIALS AND NOTES	SAMPLE SCRIPT
BLM–27 	Display BLM–27. Allow about 1 minute per group for each to report their decisions.	**Let's look at the decisions you made.**
As time permits, have groups explain their strategies for collaborating and reviewing the items, as well as their criteria for choosing items. *Sample responses: groups may decide to balance the levels of difficulty; choose a variety of item types; some may prioritize components and/or provide a variety of contexts such as using an area/perimeter item rather than an angle measure item if another chosen item already involved angle measure.*	**What other criteria did you use?**
Review the matrix to see which items were chosen by many groups and which were not. Discuss the reasons for group choices.	**Do we have agreement here?**

MATERIALS AND NOTES

G. RETRACING OUR STEPS
(5–10 MINUTES)

Review: By displaying findings in this way, we can address gaps and overlaps in the matrix and consider the implications for assessment.

For example, we could see where to add more items (to fill gaps) or discard items (where there is overlap). Items could be revised to cover more of the standards or to be more tightly aligned with the standards they now address (as in Module 1). The cross–mapping procedure could be repeated with more items, attempting to select a set of items (or revising items) that provide sufficient coverage of the standards. Based on our findings, we would continue to identify gaps and overlaps and make recommendations. Tightly aligning select items in this way provides the basis for deeper discussions with groups that identify Module 3 material as part of their next steps.

SAMPLE SCRIPT

What are the gaps? What are the overlaps?

If more items were available, what would we want those items to address?

If we could alter these items rather than adopt them, how would we redesign them?

At some point, we must ask, even if all these items were used, would there be enough evidence? Can one test tell all? Of course not. Which is why the Big questions remain: *How do we know if we have enough evidence?* and *Do we have the right evidence?*

- **This process provides us with a decision–making tool for answering the questions: Do we have enough evidence? Do we have the right evidence?**

MATERIALS AND NOTES

SAMPLE SCRIPT

Ask participants to identify additional and/or more specific ways this process might be useful to them in their work and how this process could be a useful tool for students.

How else might this tool be used?

For example, the process represents a collegial tool for working with other stakeholders to analyze a variety of education–related products and processes (such as educational programs, texts, activities, materials, other resources, etc.), to determine whether or not — as well as how — they are standards–based. Using this tool, one could attempt to justify spending several weeks on a project in a mathematics class if it actually addressed a multitude of identified standards.

For additional Extension and Expansion ideas, refer to the Facilitator Support.

H. REFLECTION
(5 MINUTES)

BLM–15

Display BLM–15.

For feedback purposes, ask one or more reflection questions, such as those provided on BLM–15.

Allow participants a few minutes to jot down their responses. Conclude with group sharing and a discussion of "next steps." This could lead to action plans for individuals, as well as for the group as a whole.

Now that you have been part of this process, take a few moments to think about your responses to the following prompt(s):

- ***Something I am thinking about differently is...***
- ***Because of what I learned today, something I will do differently is...***

SAMPLE RESPONSES — Module 2

Geometry, Spatial Sense, and Measurement

Mathematics instructional programs should include attention to geometry, spatial sense, and measurement so that by the end of the eighth grade all students can —

STANDARD	Item 1	Item 3	Item 5	Item 7	Item 9
a) analyze characteristics and properties of two- and three-dimensional geometric objects;		a2: sum of 3 angles of a triangle is 180°	a1: describe and classify straight angles a1/a2: analyze a linear pair a2: angles in linear pair add to 180° a4: creating relationship of 5:4	a3: use proportional reasoning a2: understand similarity of triangles	a3: use proportional reasoning a2: understand similarity of triangles
b) select and use different representational systems, including coordinate geometry and graph theory;	b1: use coordinate geometry to look for linear relationship b1: display points in a linear fashion b1: coordinate pairs, graphing b2: examine the properties using common slopes				
c) recognize the usefulness of transformations and symmetry in analyzing mathematical situations;		c1: position figures under informal transformation (e.g. flips + turns + slides) c3: understand the concepts of congruence using transformation		c3: understanding similarity with a slide	c1: slides in transformation c2: rotational symmetry c3: congruence for transformation
d) use visualization and spatial reasoning to solve problems both within and outside of mathematics;	d3: using model to explain algebraic relationship d3: lines represent algebraic relationship	d3: use visualization and spatial reasoning d3: geometric model to explain numerical relationship	d3: using algebra to explain geometric relationships d3: model represents algebraic equation d3: angle represents algebraic relationship		d2: compose - decompose
e) understand attributes, units, and systems of measurement;			e1: estimate, measure angles e1: estimate size of angle		
f) apply a variety of techniques, tools, and formulas for determining measurements.	f6: appropriate scale for model			f5: using ratios and proportions to solve problems	

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SAMPLE RESPONSES — Module 2
Geometry, Spatial Sense, and Measurement — cont'd

Item 12	Item 14	Item 16	Item 17	Item 19	Item 20	Item 21
	a2: analyze geometric relationship between angles a4: inductive and deductive reasoning to calculate angles		a1: describe and classify main features	a4: deduce ideas and relationships		a4: its patterns create inductive and deductive arguments
	d2: compose new angles — decompose existing angles d3: geometric model to explain numerical relationship between angles	c1: rotations of triangles as pattern rows continue d3: model for algebraic and numerical relationships	d3: model for algebraic and numerical relationships	d3: model to explain numerical and algebraic relationships	d3: models for algebraic and numerical relationships	
f2: use formula for perimeter	f4: using an algorithm to measure angles			f5: proportion of black to clear	f2: area and perimeter f6: scale drawing f5: ratio for scale factors	

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SAMPLE RESPONSES — Module 2
Patterns, Function, and Algebra

Mathematics instructional programs should include attention to patterns, functions, symbols, and models so that by the end of the eighth grade all students can —

STANDARD	Item 1	Item 2	Item 5	Item 6
a) **understand various** types of **patterns and functional relationships;**	**a1**: use numeric patterns **a2**: use patterns to solve mathematical problems **a3**: represent a graph	**a2**: use patterns to solve problem **a1**: analyze pattern		
b) **use symbolic forms to represent and analyze mathematical situations and structures;**	**b4**: use point-slope formula to find relationship between points and given line **b3**: solve problem using equations **b2**: determine relationship between points	**b4**: use symbolic algebra to solve problem	**b4**: use symbolic algebra to set up and solve linear equation	
c) **use mathematical models and analyze change in both real and abstract contexts.**	**c1**: model with a graph **c2**: using slope to find relationships of constant rate of change to determine another point on the line **c3**: determine change (slope) between points to get next point	**c3**: explore change		

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SAMPLE RESPONSES — Module 2
Patterns, Function, and Algebra - cont'd

Item 8	Item 10	Item 12	Item 16	Item 18
			a1: generalize numeric and visual pattern **a2**: use patterns to solve problem	
b1: understand equation and variable **b4**: use symbolic algebra to represent situation	**b1**: develop understanding of equation and variable **b4**: use symbolic algebra to solve linear relationship	**b1**: understand equation and variable **b4**: represent situation with variables		**b1**: develop understanding of equation and variable **b4**: use symbolic algebra to represent situations and solve problem

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MODULE Three

Planning Instruction to Support Standards

OVERVIEW OF MODULE 3

Geometric or Algebraic Thinking Options

SUMMARY

Module 3 introduces a standards–based instructional planning guide as a way to respond to the question: *How do we link the assessment to instruction?* Using this guide, participants examine sample assessment items aligned with a standard. They then determine what student learning experiences could lead to achievement of that specific standard. Thus the mathematics found in the assessment items and the required student learning experiences guide the process of developing a standards–based instructional plan.

PURPOSE

As a result of engaging in Module 3, participants will:

- learn to use a standards–based instructional planning model;
- identify required learning experiences based on standards; and
- match instructional strategies and materials to identified student learning experiences.

TIME REQUIRED

Approximately 2+ hours

SPECIAL NOTES

- Materials provided allow you to focus on either geometric ***or*** algebraic thinking.
- This session is even more effective when preceded by Modules 1 and 2. If participants have identified the most critical assessment items in Module 2 and then confirmed that the items are tightly aligned to the identified standard, the resulting items should be used for this experience.
- To customize this module, use your own district or state Standards.
- For Extension and Expansion ideas see the Facilitator Support section.

PREPARING FOR MODULE 3

Geometric or Algebraic Thinking Options

MATERIALS TO PREPARE

TRANSPARENCIES

Module 3 Title Page **(BLM–1c)**
Guiding Questions **(BLM–2)**
Large–scale Assessment **(BLM–4)**
Alignment Model **(BLM–5)**
Alignment Quote **(BLM–6)**
Instructional Planning Process **(BLM–28)**
***Standard:** Geometric* **(BLM–16)** *or Algebraic Thinking* **(BLM–17)**
What mathematical thinking would our students use? **(BLM–30)**
***Item:** Geometric* **(BLM–21)** *or Algebraic Thinking* **(BLM–7)**
How do we link the assessment to instruction? **(BLM–33)**
Instructional Planning Worksheet **(BLM–34)**
What, where and when? **(BLM–14)**
Afterthoughts **(BLM–15)**

HANDOUTS

Guiding Questions/Alignment Model **(BLM–3)**
Standards–based Instructional Planning Model **(BLM–29)**
***Standard:** Geometric* **(BLM–23)** *or Algebraic Thinking* **(BLM–24)**
***Item Set:** Geometric* **(BLM–31a–b)** *or Algebraic Thinking* **(BLM–32a–b)**

LARGE WALL POSTERS

Guiding Questions **(BLM–2)**
Alignment Model **(BLM–5)**

FACILITATOR SUPPLIES AND EQUIPMENT

Overhead projector and screen
Pens for overhead
Blank transparencies
Masking tape
Chart markers and chart paper
Easels (optional but helpful)

PARTICIPANT SUPPLIES

Sheets of chartpaper or newsprint *(at least two per group of 4)*
Colored markers or crayons *(at least two per group of 4)*
Scratch paper

ROOM SETUP

Post charts of the *Alignment Model* and *Guiding Questions* in prominent locations so that they can be referred to throughout the session. In addition, you will need:

- accessible wall space for displaying participants' work;
- seating arrangement for partner and small group work; and
- traffic patterns designed to allow easy access to display area.

TRANSPARENCIES AND HANDOUTS FOR MODULE 3

Geometric or Algebraic Thinking Options

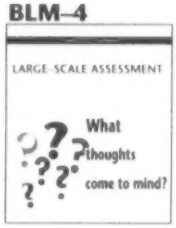
FROM APPENDIX A

TRANSPARENCIES

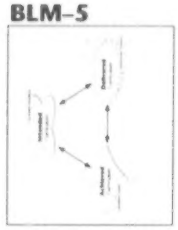
BLM–1c

BLM–2

BLM–4



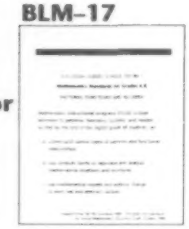
BLM–5



BLM–6

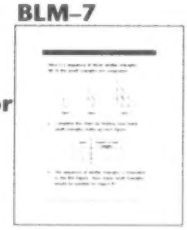
BLM–28

BLM–16 or **BLM–17**



BLM–30

BLM–21 or **BLM–7**



BLM–33

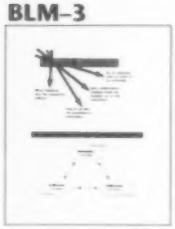
BLM–14

BLM–34

BLM–15

HANDOUTS

BLM–3



BLM–29

BLM–23 or **BLM–24**

BLM–31a–b or **BLM–32a–b**

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AT-A-GLANCE MODULE 3

Geometric or Algebraic Thinking Options (2+ HOURS)

A. WHAT QUESTIONS AND ASSUMPTIONS GUIDE THIS SESSION? (8–12 MIN.)

- ❒ Explain how this module fits with other staff development events.
- ❒ Outline **Purposes** for this session. (BLM–1c)
- ❒ Review **Guiding Questions** as an overview of the session agenda. (BLM–2)
- ❒ Discuss: **"Large-scale assessment"** What comes to mind? (BLM–4)
- ❒ Review (Introduce) recent ideas about the **Alignment Model.** (BLM–5) and (BLM–3)
  - Discuss NCTM **alignment quote.** (BLM–6)
  - Discuss **situations** where one component is not aligned and consequences of misalignment.

Omit or review if participants have previously engaged in these activities.

B. WHAT STANDARDS DOES THE ASSESSMENT ADDRESS? (10 MIN.)

- ❒ Introduce **Instructional Planning Process:** "traditional" v. "standards-based." (BLM–28) and (BLM–29)
  - ☆ How are these reflected at Classroom level? School level? District level?
  - ☆ What are the potential advantages and possible drawbacks to each?
- ❒ Distribute and display **Standard** (for Geometric or Algebraic Thinking) (BLM–16 OR 17) and (BLM–23 OR 24)
  - ☆ Record responses: What should we be teaching in middle school to meet this standard?

C. WHAT MATHEMATICAL THINKING WOULD OUR STUDENTS USE? (20 MIN.)

- ❒ Refer to **Instructional Planning Process** as a framework to identify content, required student learning experiences and related instructional practices. (BLM–30) and (BLM–29)
- ❒ Distribute **set of items.** (BLM–30) and (BLM–31 OR 32)
  - ☆ Solve in pairs. Record math content addressed by each item.
- ❒ As a whole group, review mathematical content for sample item. Record on **Content Analysis** chart.
- ❒ As a whole group, identify and record **Learning Experiences** students should have. Post chart.

D. HOW DO WE LINK THE ASSESSMENT TO INSTRUCTION? — PART 1 — Modeling the process (10 MIN.)

- ❒ Discuss: If **achieved curriculum is aligned with intended,** why might some students still fail? (BLM–29) and (BLM–9)
- ❒ Refer to **Alignment Model** and **Guiding Questions:** (BLM–5) and (BLM–2)
  - ☆ How do we link the assessment to instruction?
- ❒ Refer to the **Sample Item:** (BLM–21) or (BLM–7)
  - ☆ What **Instructional Practices** could we use to provide the learning experiences? Record and post with the **Content Analysis** and **Learning Experiences** charts.

E. HOW DO WE LINK THE ASSESSMENT TO INSTRUCTION? — PART 2 — Using the process (40–45 MIN.)

- ❒ Assign one item to each small group. (BLM–33)
  - ☆ Small groups generate **Learning Experiences** and **Instructional Practices** for their item, record on chart paper, and post.
- ❒ Have each group share work. (15 min. total)

F. ORGANIZING AND SUMMARIZING (15 MIN.)

- ❒ With whole group, present **Instructional Planning Process Worksheet.** (BLM–34)
  - ☆ Organize and summarize findings.
  - ☆ Pose questions about doing this all in 8th grade. (BLM–14)

G. RETRACING OUR STEPS (3 MIN.)

- ❒ Summarize the process in relation to the **Alignment Model.** (BLM–5)
  - ☆ Discuss: Teaching to the standards doesn't mean starting from scratch — process and choices.

H. REFLECTION (10 MIN.)

- ❒ Have participants respond to prompts and share in closing discussion. (BLM–15)

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Planning Instruction to Support Standards

Geometric or Algebraic Thinking Options

MATERIALS AND NOTES

SAMPLE SCRIPT

If you have completed other *LfA* modules with the same group, ask participants to share any actions they may have taken as a result of these sessions. This discussion will serve as a review and help to set the stage for this session. Rather than re–introduce the alignment model as proposed in the script, you may want to briefly review the model and ask participants to share any recent examples of non–alignment which may have come to their attention. Then describe how this session relates to the previous one and why it is important.

A. WHAT QUESTIONS AND ASSUMPTIONS GUIDE THIS SESSION?

(8–10 MINUTES)

Following an introductory activity, explain how this module fits in with your other professional development efforts, including other modules in this ***Learning from Assessment*** series.

BLM–1c

Display BLM–1c to outline the purposes and set the agenda for this session.

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During this session, we will use a set of assessment items selected from TIMSS — the Third International Mathematics and Science Study — to explore how assessment relates to curriculum standards and how we can use assessment to inform our instructional practice.

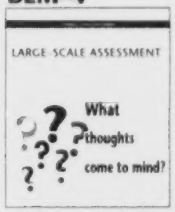
MATERIALS AND NOTES

BLM–2

Display BLM–2 and refer to the large poster of the *Guiding Questions* as you present the session overview. Highlight the three Guiding Questions for this module.

Although the Guiding Question Are we assessing what we think we are assessing? *is a major focus in other sessions it is not directly addressed in this session.*

BLM–4



Display BLM–4 and pose the rhetorical question for individual reflection, so participants begin to reconsider their view of large–scale assessment beyond its typical use.

Allow a few moments for participants to share their thoughts with partners or with the whole group.

The emphasis is not on "teaching TO the test" but "teaching WITH the test in mind."

SAMPLE SCRIPT

As we look at assessment through standards, these questions will help to guide our discussions. We will approach the questions in this order as we analyze the assessment items and their instructional implications.

- **What standards does the assessment address?**
- **What mathematical thinking would our students use on the assessment?**
- **How do we link the assessment to instruction?**

How does "large–scale assessment" in mathematics currently affect your instruction?

Typically, we think of large–scale assessments as instruments to evaluate student performance — either students answer the items correctly or they don't. We rarely have the opportunity to examine the items, nor do we consider how these items can help us in our own work.

In this session, we engage in a process of planning instruction WITH the test in mind. We use these large–scale items to better align our *delivered* curriculum with our *intended* curriculum.

MATERIALS AND NOTES

BLM–5

BLM–3

Display BLM–5, refer to the large poster of the *Alignment Model*, distribute BLM–3, *Guiding Questions and Alignment Model*.

Even participants who are familiar with the model benefit from reviewing the material, and by sharing any recent examples of non–alignment.

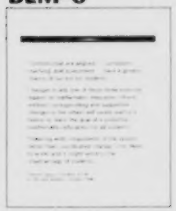
SAMPLE SCRIPT

For our purposes, we are using this simplified Alignment Model to illustrate how three major components of our educational programs are related:

- **CURRICULUM STANDARDS represent what the district or the state designates as the *intended curriculum.***
- **INSTRUCTIONAL PROGRAMS consist of the written curriculum of a district (the scope and sequence), the materials used for instruction, and what teachers and students actually do in the classroom. These elements comprise the *delivered curriculum.***
- **The ASSESSMENT SYSTEM is the approach we take at the national, state, district, and classroom levels to determine what students actually know and can do. The results of the assessment represent the *achieved curriculum.***

MATERIALS AND NOTES

BLM–6



Display BLM–6 to reinforce the importance of alignment.

Provide time for partners to discuss and share their ideas.

This exercise helps emphasize the importance of aligning all three components of the curriculum — intended, delivered, and achieved and helps reinforce the need for examining assessment through standards.

Example: In one school, classes are taught using problem–based learning techniques that are consistent with and build upon district–adopted standards. While instruction and standards are aligned, the state test is multiple–choice and fact–based. Parents may demand some explanations if students do not do well!

SAMPLE SCRIPT

Systems that are aligned — Standards, Instruction, and Assessment — have greater potential for leading to student success. Changing any one of these three essential components without corresponding, supportive changes in the other two will probably work to the disadvantage of students.

What are some situations in which one of the curriculum components (intended, delivered, achieved) is not aligned with the others? What are some possible consequences of the misalignment?

Because there is such great emphasis today on Standards and Accountability, we need to ensure that our entire system is aligned. For this reason, we look at assessment through Standards.

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MATERIALS AND NOTES	SAMPLE SCRIPT

REMINDER: The following Facilitator Notes & Script provide both a Geometric and an Algebraic Thinking focus. Select the focus that best meets the needs of your group. To customize this module, use your own standards related to the sample set of items. You may also replace or extend the set of items with those from your own assessments.

B. WHAT STANDARDS DOES THE ASSESSMENT ADDRESS?

(10 MINUTES)

BLM–28

Display BLM–28 contrasting traditional and standards–based instructional planning. Be sure the differences are noted. Have participants discuss potential advantages and the possible disadvantages, or unintended consequences of each method.

BLM–29

Distribute the handout BLM–29. Point out that the *Instructional Planning Process for Standards–based Practice* provides the framework for this session.

To align delivered curriculum with intended curriculum, it is important to consider the process used for instructional planning.

Compare this *traditional* planning process to one suggested for a *standards–based* practice.

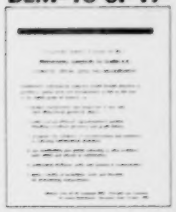
- **How do these planning methods differ?**
- **What are some potential advantages and possible drawbacks of each method?**

MATERIALS AND NOTES

SAMPLE SCRIPT

The upcoming activity requires context. Be sure participants understand the origin of the Standard and the selected items. If you are NOT using your own district/state Standards or items, build upon a context from previous *LfA* modules or adapt the scenario below.

BLM–16 or 17



BLM–23 or 24

Display the Standard (BLM–16 for *Geometric* OR BLM–17 for *Algebraic Thinking*) and distribute the corresponding handout BLM–23 *(Geometric)* or BLM–24 *(Algebraic)*.

The Euclidean Unified School District has a set of Mathematics Standards organized by strands as well as by grade–level bands. This is their grades 6–8 Geometry, Spatial Sense, and Measurement Standard [Patterns, Functions, and Algebra Standard].

As a whole group, brainstorm a preliminary list of mathematical content, concepts, and vocabulary students should know and understand in order to meet the Standard.

What should we be teaching in middle school to meet this standard?

Ask for a few ideas for each component or subcomponent. Record responses on chart paper and post for reference.

This need not be a long list. The purpose is to begin focusing on student learning, rather than to generate everything students should know and be able to do related to Geometric/Algebraic Thinking.

POSSIBLE RESPONSES FOR	
GEOMETRIC THINKING STANDARD:	**ALGEBRAIC THINKING STANDARD:**
identifying isosceles, equilateral, and scalene triangles; congruency; dimensional relationships; polygons; coordinate geometry	*graphing functions; linear change; writing equations to represent patterns; negative integers*

If participants mention strategies rather than content, be sure to focus responses on the content to be addressed rather than the materials they would use to support the content.

C. WHAT MATHEMATICAL THINKING WOULD OUR STUDENTS USE ON THE ASSESSMENT?

MODELING THE PROCESS

(20 MINUTES)

NOTE: In this module we ask participants to think about specific student learning experiences that lead to mathematics achievement. These are the experiences that provide students the opportunities to learn specific content or skills. We use student learning experiences *to describe what* STUDENTS *actually do within the delivered curriculum. We use the term* instructional practices *to imply what* TEACHERS *do within the delivered curriculum. These instructional practices include the strategies and the materials that teachers use.*

Standards are often very general in nature and promote a great deal of discussion before people agree about what they really mean. Analyzing assessment items can help clarify the meaning of the standards as well as help teachers plan their instruction to meet the standards.

Using this standard and the *Instructional Planning Process for Standards–based Practice* as a framework, we will:

- **Examine a set of assessment items which can be used with the standard to identify the mathematics content being addressed.**
- **Explore instructional implications by identifying required student learning experiences and related instructional practices.**

The Euclidean Unified School District has identified a set of items from the TIMSS to show evidence of student mastery in meeting their Geometric/Algebraic Thinking **Standard.**

According to the district, these eighth–grade items address the district's Middle School Mathematics Standards, and items like these can be used to assess student learning.

MATERIALS AND NOTES

BLM–30

BLM–31 or 32

Display the instructions (BLM–30) and distribute the handout of items (BLM–31 for *Geometric* or BLM–32 for *Algebraic Thinking*).

Allow 15 minutes for pairs to complete the set of items (#3, 7, 14, and 17 for *Geometric*; or #1, 2, 6, and 16 for *Algebraic Thinking*).

With the whole group, use the sample item (Item 3 for *Geometric* or Item 16 for *Algebraic Thinking*) to model the process for upcoming small group work.

Briefly discuss what mathematical content the item addresses and what the student is being asked to do in relation to the content. Record the responses on a chart labeled *Content Analysis*.

SAMPLE SCRIPT

Work with a partner and complete the set of items. Jot down your ideas about the mathematics content being addressed by each item.

Let's consider this item.

- **What mathematical content does the item address?**

POSSIBLE CONTENT RESPONSES FOR	
GEOMETRIC THINKING ITEM 3:	**ALGEBRAIC THINKING ITEM 16:**
congruency; the sum of the measure of angles in a triangle is 180°; corresponding parts of triangles; reflections; translations; notation	*...patterns, sequences, square numbers, similarity*

For other examples, refer to the Sample Responses on page 3–21.

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MATERIALS AND NOTES

Pose the next question and record responses on another chart labeled *Learning Experiences.*

Post this chart next to the *Content Analysis* chart.

Suggest participants consider specific **learning experiences** students need in order to be successful with the identified content. As you elicit responses from the group, let them know that order is not the issue and that you are not asking for specifics about activities or materials. This is the focus of the next step in the process.

SAMPLE SCRIPT

Think about what students should know and be able to do in relation to the content.

➪ **What learning experiences should students have with the content?**

POSSIBLE LEARNING EXPERIENCE RESPONSES FOR

GEOMETRIC THINKING ITEM 3:

identifying corresponding parts of translated (e.g., rotation, reflection, and slide) figures; translating a variety of shapes; finding the measure of a third angle in a triangle when two angle measurements are given.

ALGEBRAIC THINKING ITEM 16:

working with visual and numerical pattern; finding missing items in a series or sequence; stating rules for generating patterns.

For other examples, refer to the Sample Responses on page 3–21.

To generate additional ideas about learning experiences, have participants consider what factors might be misleading to students and contribute to incorrect responses.

FOR INSTANCE

IN GEOMETRIC THINKING ITEM 3:

Students might not recognize that the second triangle is a reflection of the first — that it had been "flipped over." Even though translations (or even reflections) appears on the list of content, students who do not have ample experience with identifying corresponding parts of reflected shapes will likely be unsuccessful on this item.

IN ALGEBRAIC THINKING ITEM 16:

Students might be misled about the true question being asked if they do not know the terminology of "congruent" and "similar." Students may not be sure which triangles are the small triangles. Some students may be confused about the use of extraneous information —the 2 and 3 — and thus be unable to proceed.

D. HOW DO WE LINK THE ASSESSMENT TO INSTRUCTION? — Part 1

MODELING THE PROCESS

(10 MINUTES)

BLM–29

Refer to the *Instructional Planning Process* handout (BLM–29) and the large poster of the *Alignment Model*. Point out that in implementing the *Instructional Planning Process* in a standards–based practice, we are aligning our intended, achieved, and delivered curricula.

Refer to the charts of *Content Analysis* and *Learning Experiences*. Briefly discuss why the system may be out of alignment by posing questions focused on student success in a seemingly aligned situation.

Responses may include: homogeneous grouping; different time of day; teacher experience; schedule changes; etc.

*If instruction — **how** content is conveyed or **how** learning experiences are facilitated — is not mentioned, probe further. Participants should recognize that differences in instructional practices or strategies contribute to differentiated student experiences and levels of success in meeting standards.*

Using a standards–based Instructional Planning Process, we chose a relevant standard (intended curriculum). We then identified related assessment items through which students would have opportunities to demonstrate what they know and can do (achieved curriculum). We thus expect the achieved curriculum to align with the intended curriculum. But what about our delivered curriculum?

Within a school that has an agreed–upon curriculum — the teachers all agree upon content and the student learning experiences required to meet the standards — why might some students still fail the assessment? Why might the students in some classrooms be more successful than others in meeting the standards?

The instructional strategies and materials that teachers use provide the learning experiences that contribute to student understanding and mastery. Even with agreed–upon content, it is instruction that determines how students actually experience the curriculum.

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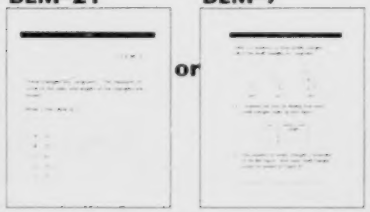
MATERIALS AND NOTES

Refer to the *Alignment Model* and *Guiding Questions* charts, highlighting ***How do we link the assessment to instruction?***

You may want to emphasize the message that we are talking about teaching WITH the test, rather than teaching TO the test.

BLM–21 **or** **BLM–7**



Display the sample item and refer participants to the student learning experiences they identified.

Label a chart *Instructional Practices* for recording whole group responses. Post this chart to the right of the *Learning Experiences* chart. Generate a few specific ideas for HOW student learning experiences should be carried out.

SAMPLE SCRIPT

By identifying the required learning experiences and planning instruction to assure that each student has adequate opportunities to learn, we help align the delivered curriculum with the achieved and the intended curricula.

In this way we address the Guiding Question: *How do we link the assessment to instruction?*

Let's revisit the item. Think about the student learning experiences we identified. Now think about HOW we provide these learning experiences.

What instructional practices — materials, methods, or activities — could we use to provide these learning experiences?

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SAMPLE RESPONSES FOR

GEOMETRIC THINKING ITEM 3:

Students find the measure of a third angle in a variety of triangles (viewed from non-typical orientations) when two angle measurements are given. Using concrete (e.g., pattern blocks) and representational models (e.g., dot paper), students practice transformations with a variety of shapes by translating, rotating, reflecting and sliding the shapes.

ALGEBRAIC THINKING ITEM 16:

Students extend patterns beyond concrete representations. Using manipulatives, students build models of various growth patterns.

Summarize responses.

You may want to relate these ideas to your own curricular materials.

By thinking in more detail about how we provide the desired student experiences, we create a better picture of what needs to happen in our classrooms and we can begin to develop a richer description for our instructional program.

MATERIALS AND NOTES

SAMPLE SCRIPT

E. HOW DO WE LINK THE ASSESSMENT TO INSTRUCTION? — Part 2

USING THE PROCESS

(40–45 MINUTES)

BLM–33

Display the instructions (BLM–33). Have participants work in small groups and assign one item from the original set (not including the sample item) to each group.

Allow 20–25 minutes for groups to generate *Learning Experiences* and at least two examples of *Instructional Practices* for their assigned item.

These should be recorded on chart paper and posted. If more than one group worked on the same item, cluster their posters.

Allow 15 minutes for groups to share their work. To facilitate verbal presentations, gather participants to the area where charts are posted.

Work in small groups and analyze one of the items.

- **Share your ideas about the mathematics content addressed by the item.**
- **Generate a list of *Learning Experiences* students should have in order to demonstrate what they know and are able to do in relation to the content.**
- **Describe two *Instructional Practices* (including materials, activities, methods) that would best support the required learning experiences for all students.**
- **Record your work on chart paper and then post your chart.**

Let's look at what you have posted: What do you notice?

F. ORGANIZING AND SUMMARIZING
(15 MINUTES)

BLM–14

Display BLM–14, posing the questions rhetorically:

- Can all of this take place in the 8th grade?
- What can be accomplished prior to 8th grade?
- What should this plan look like at various grades?

Consider everything we want students to know and all of the related learning experiences they need to successfully meet the standard by the end of the eighth grade.

BLM–34

Completing the Worksheet serves to reinforce and review the Standards-based Instructional Planning Process. Use the *Instructional Planning Process Worksheet* transparency (BLM–34) to organize and summarize the posted products. You may wish to have a volunteer record on the overhead worksheet transparencies while you facilitate the upcoming discussion.

Begin the worksheet by writing in the title of the Standard and the set of assessment items.

We can use this Instructional Planning Process Worksheet to begin to organize and capture the required learning experiences and related instructional practices for the standard.
First, we record the identified standard and the related assessment items align to the standard.

MATERIALS AND NOTES

Refer to all the posted *Learning Experiences* and ask participants to decide which they consider key elements for meeting the specified standard. Record these on the worksheet.

Refer to the posted *Instructional Practices*. Ask participants to identify which they consider to be crucial for meeting student needs. Record these on the worksheet transparency.

As time permits, discuss what data you might collect in order to complete one cycle of this *Instructional Planning Process* for standards-based practice. Prompt participants to consider multiple measures (e.g., observations, student interviews, projects).

What you do next will vary, depending upon how this session fits into a possible series, or the length of time you have allotted for this session.
For additional Extension and Expansion ideas refer to the Facilitator Support section.

SAMPLE SCRIPT

Next, let's consider a few of the Learning Experiences that are most relevant for preparing students to meet this standard and succeed on assessment items like these?

Which Instructional Practices do we consider most likely to prepare students to meet this standard and support the identified learning experiences?

What types of assessment data would provide feedback so that we know what our next steps should be?

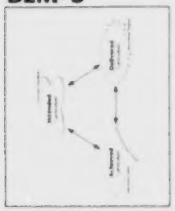
Once all of the pertinent information for a standard is captured, we can decide how best to sequence the instructional practices.

MATERIALS AND NOTES

SAMPLE SCRIPT

G. RETRACING OUR STEPS
(3 MINUTES)

BLM–5



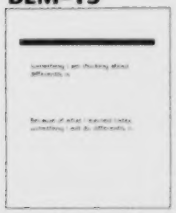
Display BLM–5. Indicate the interaction of the three components on the model.

Participants should understand that teaching to the standards doesn't mean starting from scratch. If standards and assessment are aligned, teachers can focus on what specific instructional practices will provide students the learning experiences necessary for meeting the standards.

Using a standards–based instructional planning process, we learn that analyzing assessment items can actually enhance our instructional program and help ensure that all the components are aligned.

H. REFLECTION
(10 MINUTES)

BLM–15



For feedback purposes, ask one or more reflection questions, such as those provided on BLM–15. Allow participants a few minutes to jot down their responses. Conclude with group sharing and a discussion of "next steps." This could lead to action plans for individuals, as well as for the group as a whole.

Now that you have been part of this process, take a few moments to think about your responses to the following prompt(s).

- ***Something I am thinking about differently is...***
- ***Because of what I learned today, something I will do differently is...***

SAMPLE RESPONSES FOR GEOMETRIC THINKING ITEM ANALYSES

ITEM #	WHAT MATHEMATICAL CONTENT (VOCABULARY AND CONCEPTS) DOES THE ITEM ADDRESS?	WHAT LEARNING EXPERIENCES SHOULD STUDENTS HAVE WITH THE CONTENT?
3	congruent corresponding parts notation sum of angles in a triangle = 180° transformations/translation/ rotation	➡ identifying corresponding parts in transformed/translated figures ➡ identifying translations/rotations of various shapes, especially triangles ➡ finding measure of third angle in a triangle when two angle measures are given
7	similar triangles notation corresponding parts proportion	➡ identifying corresponding sides of similar figures, especially triangles ➡ setting up and solving proportions
14	notation overlapping angles arithmetic angle measure	➡ identifying angles from notation ➡ labeling figures ➡ finding measures of overlapping angles ➡ reading diagrams
17	notation concept of area; area of square, area of rectangle "equal size" square numbers	➡ working backwards ➡ solving multi-step problems ➡ using area and perimeter in same problem ➡ unit analysis and notation

SAMPLE RESPONSES FOR ALGEBRAIC THINKING ITEM ANALYSES

ITEM #	WHAT MATHEMATICAL CONTENT (VOCABULARY AND CONCEPTS) DOES THE ITEM ADDRESS?	WHAT LEARNING EXPERIENCES SHOULD STUDENTS HAVE WITH THE CONTENT?
1	ordered pairs slope plotting points point-slope formula Cartesian coordinate system	➡ plotting points on a graph ➡ using rulers ➡ finding slopes
2	numerical patterns functions relations	➡ using patterns to solve problems ➡ represent relationships in a table ➡ working backwards
6	rational numbers (fractions) subtraction proportional change	➡ writing equations ➡ using variables ➡ drawing visual representations
16	vocabulary: sequence, congruent, similar patterns square numbers	➡ using patterns to solve problems ➡ creating and generalizing numeric and visual patterns ➡ using tables ➡ squaring numbers, finding roots ➡ selecting relevant data or ignoring extraneous data

FACILITATOR SUPPORT: PLANNING TOOLS

Meeting District Needs with L*f*A Materials

As a professional development provider, your work serves at least two major purposes: to promote organizational change, and to improve and enhance individual teacher practice. The *Learning from Assessment* modules are intended to be a resource as you work with groups of teachers over a period of time to build new knowledge and skills that can be translated into practice.

LfA materials can be used to support your responsibilities in *promoting organizational change* in the following ways:

- *Orientation to local content standards:* Facilitate an understanding of standards and how they can be translated into practice for teachers new to the district or for all teachers when the standards are initially adopted.
- *Development of district assessments:* Correlate the district standards and assessment in a matrix to discover gaps and overlaps.
- *Curriculum articulation:* Determine curriculum content at selected grade levels aligned with standards and accompanied by appropriate assessments.
- *Design of replacement units or new courses:* Identify appropriate standards, develop the assessments, and create an instructional plan (strategies and materials).

When your goal as a professional developer is *improving and enhancing individual teacher practice*, the *LfA* materials can support your efforts to:

- Assist in selection or design of classroom assessment tools aligned with instruction as well as with local standards.
- Modify teachers' instructional practices, including assessment approaches.

Basic sessions are expressly designed for two–hour time frames to encourage use by site–based groups of teachers who may schedule sessions after school hours. Although each basic module can serve as a stand–alone session, the entire package is designed as part of a long–term professional development effort.

Creating an L*f*A Action Plan

Respond to the questions in this *Self–Assessment Guide* to help you decide how to use the *LfA* materials to meet your goals and the needs of your participants.

SELF–ASSESSMENT GUIDE

Before deciding exactly how you want to use the LfA materials, take a few minutes to answer the following questions:

What are my goals for working with the group?

- ❒ Understanding and implementation of standards
- ❒ Articulation within the mathematics curriculum
- ❒ Development of curriculum materials, e.g., courses, units
- ❒ Development of assessment items

How would I describe the participants in terms of their background and experience?

- ❒ Are required to participate
- ❒ Have volunteered to be in the group
- ❒ Have worked together in the past
- ❒ Have opportunities to meet and collaborate outside of the formal sessions
- ❒ Are new to teaching
- ❒ Are new to teaching mathematics but experienced in teaching
- ❒ Are new to the district
- ❒ Are unfamiliar with local standards
- ❒ Have an awareness of the standards
- ❒ Have spent time reviewing and discussing the standards

What time structures are available to work with the group?

- ❒ Short series of after–school sessions
- ❒ Long–term series of after–school sessions
- ❒ Several all–day sessions, combined with after–school sessions
- ❒ Series of all–day sessions
- ❒ Intensive series of consecutive, all–day sessions

How will I know if I am reaching my goals and making an impact?

- ❒ End–of–session feedback forms
- ❒ End–of–session reflection time
- ❒ Individual participant action plans
- ❒ Follow–up interviews with participants
- ❒ Monitoring of participant action plans
- ❒ Product development

Based on your responses, a specific action plan can help you tailor sessions to the needs of the stakeholders with whom you work — district level administrators, colleagues, teachers, and site administrators — while accomplishing your own goals. The action plan is a

versatile tool to use in reviewing and organizing the results of needs assessments, designing your next steps, and monitoring your own progress in reaching goals.

If you are unfamiliar with action plans, we have shown a sample action plan form below to help you design and implement your professional development strategies and activities. You may supply participants with a similar form as an additional resource to be used in developing group action plans around specific objectives.

SAMPLE ACTION PLAN

Goal (Intended)

What major goal or objective would you like to reach? This could be a broad goal, a specific activity, or action that you would like to accomplish. Use your needs assessment results or a list of important questions to help you describe each major goal. Use a separate form for each goal.

Evidence of Success (Achieved)

How will you know if you are reaching your goal and/or making progress? What will it mean for the professional development experiences to be successful? What does it mean if participants show progress?

Staff Initiative

Is this work part of a special program, project, or department effort? Describe the organizational support in working towards this goal.

When? What? How? Who? How Well? (Delivered)

Who will be responsible for what task? When will it be done? How will it be reviewed? revised? used?... Describe actions (the WHATs) that will help you reach your goal. For each action, specify: HOW it will take place; WHO will take responsibility; WHEN it will be done; and any criteria for HOW WELL it should be done. Be sure to include reviews of progress in the list of WHATs.

Reflections on Action

Once some of your actions are underway, evaluate your progress and determine if it's time for a mid-course correction and replanning. Don't forget to document your progress.

ACTION PLAN

GOAL:

EVIDENCE OF SUCCESS

STAFF INITIATIVE

WHEN?	WHAT?	HOW?	WHO?	HOW WELL?

REFLECTIONS ON ACTION

Analyzing your collection of action plans can help you determine whether or not you are addressing all of the important goals or needs of your stakeholders. This analysis can also be valuable in documenting your own progress and accomplishments. You may wish to adapt the matrix–mapping tool in the second *L/A* module, *Collecting Standards–based Evidence*, to display the methods used to meet your professional development goals. This format is useful for generating reports that show gaps and overlaps in addressing goals, time lines, accomplishments, and impact.

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In the following table, the first column, *Standards/Goals*, is intended to show your goals or objectives for planned staff development activities. These may be stated as part of a vision or mission, or may be key outcomes for which you are responsible (e.g., all teachers understand the state standards; new math curriculum is implemented and articulated across the grades; assessment is integrated with instruction; assessment and instruction align with standards).

SAMPLE ACTION PLAN MATRIX

	EVENTS / INITIATIVES				
STANDARDS/GOALS	**Study Groups**	**L/A Module 1**	**L/A Module 2**	**L/A Module 3**	**Case Discussion**
Teachers understand importance of alignment of assessment with standards	10/16 Assessment readings	11/14 Learn process			
Teachers familiar with district standards	12/14 Review district standards	11/14 Awareness 12/15 Apply process with district items and standards			
District and classroom assessment accommodate access and equity for all students	1/17 Follow-up issues of opportunity to learn,...	1/23 Focus creating equitable and accessible items			1/22 Equity case

The *Events/Initiatives* columns can be used to describe various professional development strategies, scheduled workshops and conferences, or staff meetings. Likewise, these columns could specify separate school or district–sponsored initiatives, such as Eisenhower–funded projects or programs, Family Math Nights, Saturday academies, or PTSA events. Action plans and other supporting documents provide the details. The cells within the matrix indicate dates and more specifics about the groups, responsible individuals, and results. Mapping the details of your work plan can ensure that your action plans adequately address intended goals.

Included in this *Facilitator Support* section are three sample scenarios for structuring the use of *Learning from Assessment* materials. Refer to them as you develop your own action plan *(see page FS–9)*.

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Monitoring Progress and Assessing Impact

The action planning process is similar to the instructional planning process introduced in Module 3, *Planning Instruction to Support Standards*. A goal or standard is identified and the next step is to describe how you will know if you have accomplished the goal — i.e., What is your assessment plan? To help monitor your progress and assess the impact of your work, you will need to collect various pieces of evidence throughout the implementation of your action plan. The data you collect can help you refine your plans as well as validate your efforts. Identifying the ways you will collect evidence is part of the planning process.

There are five levels for gathering evaluation information about professional development activities. These levels are hierarchical in that "success at one level is usually necessary for success at levels that follow."

1. ***Participants' reactions*** — questionnaires that typically provide rating scales or open-ended items allowing comments about immediate experiences, including logistics.
2. ***Participants' learning*** — measures of knowledge, skills, and perhaps new attitudes gained and unintended learnings; could be oral or written reflections, reactions to scenarios; seek multiple measures based on learning goals of the session.
3. ***Organizational support and change*** — evidence that focuses on organizational factors that support success, such as whether or not resources were made available.
4. ***Participants' use of new knowledge and skills*** — measures such as observations and written personal reflections that follow professional development experiences over a period of time to determine levels of use.
5. ***Student learning outcomes*** — multiple measures (of achievement, attitudes, skills and behaviors) that indicate the impact of the professional development experiences on students, keeping in mind potential "unintended" consequences.

From: Guskey, Thomas "The Age of Our Accountability" Journal of Staff Development, National Staff Development Council, Volume 19, Number 4, Fall 1998.

You will want to know what participants have learned as well as how effectively each session was implemented. Consider collecting evidence of what participants have learned by posing reflective questions at the end of each session. Frame the prompts around your specific goals and/or ask what participants thought was the BIG IDEA of the session.

During field testing of these materials, we learned a great deal about teachers' new insights through oral as well as written feedback. You may want to include some of these prompts in your own feedback instruments:

- What was the most useful or meaningful thing you learned?
- What question(s) remain uppermost in your mind as the session ended?

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- What do you think was the BIG IDEA of today's session?
- How will you use what you learned?

Also, consider aligning the first few items of your evaluation form with the purposes or goals of the session. Participant ratings of how well goals were met will provide feedback useful in planning future activities.

For example, the purpose of Module 1, Aligning Assessment to Standards, is that participants will:

- become familiar with standards;
- discuss interpretation of standards;
- develop a "critical eye" for selecting assessment items; and
- learn how to align assessment with standards.

Your evaluation form might include items such as these:

This *LfA* session has four goals. Using a rating scale of **1** to **5**, with **1** representing *not very successful* to **5** representing *extremely successful*, please rate and comment on our level of success in reaching each of the goals.

	not very successful		moderately successful		extremely successful
1. BECOMING FAMILIAR WITH STANDARDS.	1	2	3	4	5
Comments:					
2. DISCUSSING INTERPRETATIONS OF STANDARDS.	1	2	3	4	5
Comments:					
3. DEVELOPING A "CRITICAL EYE" FOR SELECTING ASSESSMENT ITEMS.	1	2	3	4	5
Comments:					
4. LEARNING A PROCESS OF ALIGNING ASSESSMENT TO STANDARDS.	1	2	3	4	5
Comments:					

As evidence of your progress and/or impact, you need to do more than collect structured workshop evaluations. Record the information you collect on how participants plan to use their new knowledge. Follow up, and find out what they actually do after the sessions, what the results were, and what barriers they encountered. This research can tell you how effective the session was and identify new elements to add in the future.

At the end of the sessions, or series, devote time to action planning. During this time, participants can work together to create a group as well as an individual plan. The group action plan can then serve as an on–going part of future sessions, as you review what has been done and what still needs to be accomplished.

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Extensions and Expansions

Suggested variations can be used to develop each module beyond a basic two–hour session. These variations can be incorporated to create a variety of sequences for a professional development series focused on mathematics assessment.

EXTENDING AND EXPANDING MODULE 1 — ALIGNING ASSESSMENT TO STANDARDS

Plan sessions in which participants:

- Apply the process using your local state or district standards.
- Revisit the process with additional assessment items.
- Discuss the many interpretations of standards and the variety of ways the standards are reflected in individual classrooms.
- Examine the articulation of one aspect of the mathematics curriculum (e.g., algebraic thinking) within, as well as across, grade levels.

Use the first part of the PBS *Mathline*® video ***Hop To It!*** to help illustrate:

PBS Mathline®

- What mathematical thinking would our students use on the assessment? and
- Are we assessing what we think we are assessing?

Build upon the Module 1 responses that identify requisite student mathematical knowledge and learning experiences to explore questions such as:

- What instructional strategies are we currently using to provide these experiences?
- How can we best provide the identified student learning experiences?
- What should we teach, how should we teach it and when?

EXTENDING AND EXPANDING MODULE 2 — COLLECTING STANDARDS–BASED EVIDENCE

After participants have identified the five assessment items to be used in the hypothetical school district example, utilize the analytical tools in Module 1 to tightly align the five selected items to the Standard.

Discuss methods other than testing that can be used to collect standards–based evidence about student understanding and competency. Describe how these methods map on to the Standards/Assessment Matrix.

Use the Standards/Assessment Matrix format for analyzing how well curriculum materials, classroom projects, or extended activities map on to the Standards.

Expand the Standards/Assessment Matrix vertically to include additional Standards and repeat the analysis of assessment items, curriculum materials, classroom projects, or extended activities.

EXTENDING AND EXPANDING MODULE 3 — PLANNING INSTRUCTION TO SUPPORT STANDARDS

Build upon group discussions to:

- Share methods and materials currently being used to support identified learning experiences;
- Create sequences of lessons that support identified learning experiences and operationalize the instructional plan created by the group; and
- Examine the articulation of content and instructional strategies across grade levels as they relate to the specific standard and the related student learning experiences.

Incorporate the ***Hop To It!*** video produced by PBS *Mathline*®. (If you used the first segment of the video with Module 1, show part two to illustrate how to link assessment to instruction.)

PBS Mathline®

Repeat the cross–mapping process with multiple Standards as a way to develop replacement units that are Standards–based.

FACILITATOR SUPPORT: PLANNING TOOLS

Sample Sequences for Using L*f*A Materials

There are many ways to sequence *LfA* activities. To develop your plan, consider your goals, the amount of time you have available, the length of the series, and the composition of the group. Shown here are three sample sequences, which include Supplementary Activities.

Sample Sequence 1

GOAL: LEARNING THE L*f*A PROCESSES TO DEVELOP SKILLS IN ALIGNING ASSESSMENT AND INSTRUCTION TO STANDARDS

4–HOUR SESSION

Magnetic Words warm-up
Altered Assessments
Module 1: *Aligning Assessment to Standards*
— learn process for alignment

2–HOUR SESSION

Module 2: *Collecting Standards-based Evidence*
— build a matrix and select specific assessment items

2–HOUR SESSION

Use processes from Module 1 to align the items selected in Module 2 with the standard

2–HOUR SESSION

Module 3: *Planning Instruction to Support Standards*
— use newly aligned assessment items; identify required student learning experiences and related instructional strategies to create a plan

Option: Repeat series with local standards and assessment items.

Sample Sequence 2

GOAL: LINKING ASSESSMENT TO STUDENT THINKING AND INSTRUCTION

1/2–DAY SESSION

Magnetic Words warm-up
Module 1: *Aligning Assessment to Standards*
— learn the tools
— show segment one of ***Hop To It!*** video

1/2–DAY SESSION

Module 2: *Collecting Standards-based Evidence*
— build a matrix and select specific assessment items
Altered Assessments

1/2–DAY SESSION

Module 3: *Planning Instruction to Support Standards*
— create an instructional plan
— show second segment of ***Hop To It!*** video to support planning instruction

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Sample Sequence 3

GOAL: CREATING NEW CURRICULUM (COURSES OR UNITS) ALIGNED WITH LOCAL STANDARDS OR BEGINNING ARTICULATION EFFORTS

2–HOUR SESSION

Magnetic Words warm–up
Jig–Saw with readings about assessment and standards
Introduce the alignment model and do the *Examining Resources to Support Alignment* activity

2–HOUR SESSION

Module 1: *Aligning Assessment to Standards*

2–HOUR SESSION

Module 2: *Collecting Standards–based Evidence*

2–HOUR SESSION

Local version of Module 2 with local standards and items; select items

2–HOUR SESSION

Altered Assessments
— examine selected items; modify for classroom use

2–HOUR SESSION

Module 3: *Planning Instruction to Support Standards*
— utilizing local standards with local aligned items, begin to identify required student learning experiences and specific instructional practices

2–HOUR SESSION

Continue refining learning experiences and instruction (a big list) for middle school mathematics

2–HOUR SESSION

Sharing of groups' work

2–HOUR SESSION

Articulation emphasis: *Learning Experiences and Instructional Strategies:* when to do what?

2–HOUR SESSION

Refining the middle school mathematics curriculum to meet standards
Plans for implementation
Needs assessment for making it happen

FACILITATOR SUPPORT: SUPPLEMENTARY ACTIVITIES

Magnetic Words

A 10–15 MINUTE WARM-UP ACTIVITY

Overview

Words carry different meanings and associations for every individual. To those who work with students and teachers on a regular basis, terms related to assessment certainly conjure up a variety of hopes and fears. In the following "warm–up" activity, each participant is encouraged to work within the group to build a common vocabulary around key *magnetic words* related to the *LfA* modules. As they discuss their reactions to and viewpoints toward the terms *Assessment, Curriculum, Instruction, Alignment* and *Accountability*, the group members also provide the facilitator with a way to assess their backgrounds and experiences.

Purpose

- To help both individuals and the group as a whole build a common vocabulary.
- To set the stage for the planned professional development session.
- To facilitate sharing of individual viewpoints toward education and professional priorities.

Materials

"Table–tent" cards, each displaying a different magnetic word *(1 per table of 4 to 6 people)*

LfA Magnetic Words

Assessment, Curriculum, Instruction, Alignment, Accountability

Facilitator Notes

For this activity, participants are seated at tables.

1. Ask participants to introduce themselves to others at their table, and to discuss what attracts or repels them about their magnetic word.
2. Quickly circulating around the room, have a spokesperson from each table report to the whole group, summarizing their discussion related to the magnetic word.
3. Use questioning techniques and rephrasing to connect the group responses to the content and purpose of the *Learning from Assessment* module.

Altered Assessments

A 45-MINUTE "SPRINGBOARD" ACTIVITY

Overview

In this activity, participants review a variety of short, related assessment items and analyze them as to the amount and type of information each might elicit from students. By noting slight changes in context as well as content and the way in which questions are asked, participants learn ways that tasks can be modified to be more powerful.

Purpose

- To create dialogue around assessment as a "snapshot" of students' knowledge and understandings from which we make inferences about what students know and can do.
- To review a range of task types that highlight subtle characteristics that affect their usefulness and appropriateness as assessment items.

When to Use

With Module 1, to examine various task formats and modifications that can create more powerful assessment items, that will elicit desired outcomes and better meet targeted Standards.

With Module 2, when the emphasis turns to collecting multiple measures representing a variety of item types, at various levels of difficulty.

During Module 3, to design tasks that provide powerful learning experiences and embed assessment with instruction.

Materials

- Transparency of the Mathematics Multiple–Choice Item
- Handouts of the Altered Assessment Mathematics Tasks

FACILITATOR SUPPORT: SUPPLEMENTARY ACTIVITIES

ALTERED ASSESSMENTS — continued

Facilitator Notes

When introducing the activity, acknowledge that a fair amount of classroom time involves preparing for and conducting large–scale assessments. Although knowing how to use the results of such assessments is critical, teachers can also utilize the items themselves in ways that foster learning and understanding for students. This session provides a way for students and teachers to learn from the assessment.

1. Display the item transparency of a multiple–choice item that appeared on the 1992 National Assessment of Educational Progress (NAEP).

   Discuss as a whole group: *(Allow about 6–8 minutes.)*

   - What mathematics would students need in order to answer correctly?
   - What would student answers — whether right, wrong, or simply an "I don't know" — tell about their understanding of area and perimeter?
   - Forty-five percent of U.S. 12th graders correctly answered "A." What would you do if these results were from your class?

The perimeter of a square is 24 centimeters. What is the area of that square?

A. 36 square cm
B. 48 square cm
C. 96 square cm
D. 576 square cm
E. I don't know.

Note that for the purposes of the NAEP assessment, which aims to generalize results from a large number of items to an entire population, this item may have provided satisfactory data. However, to meet the needs of a teacher seeking information to help guide instruction, the item also provides learning opportunities — for students as well as for the teacher.

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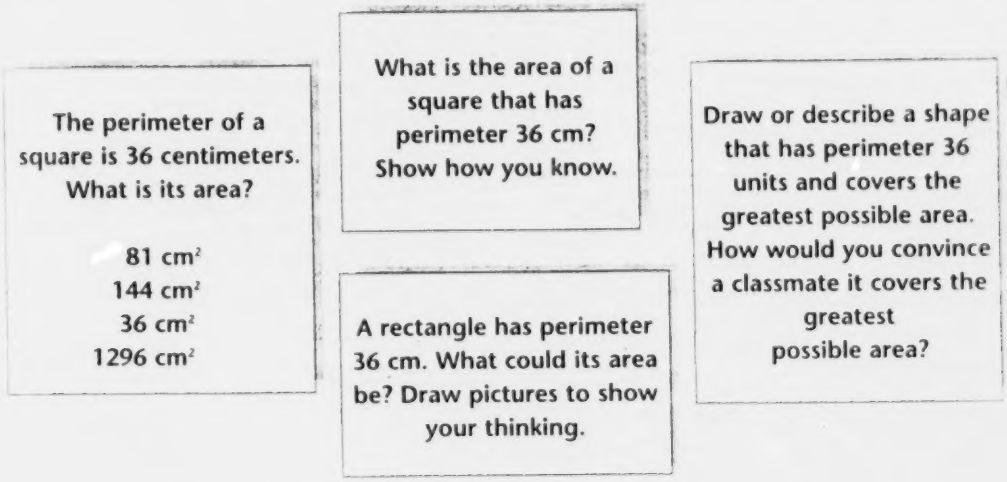
2. Ask and discuss: *How could you use this item — "as is" or with minor modifications — to learn more about what your students know and can do? (Allow about 5 minutes, including discussion.)*

   Possible responses: Present item "as is" and have students explain their choice and/or show why their choice is correct in more than one way; present item without options and have students show their work; change the numbers slightly so that fractional numbers are necessary.

   If not mentioned by the group, note that one powerful suggestion is to present the item "as is" and have students analyze each option, trying to explain the reasoning of someone who might choose it. In this way, students investigate possible misconceptions that could lead to an incorrect solution, as well as reinforce the mathematical thinking that leads to the correct solution.

3. Distribute the Altered Assessment Mathematics Tasks handout. Have participants work with a partner or in small groups to analyze the tasks, identify the types of information each might elicit from students, and create an altered task of their own. *(Allow about 20 minutes.)*


The perimeter of a square is 36 centimeters. What is its area?
81 cm²
144 cm²
36 cm²
1296 cm²
What is the area of a square that has perimeter 36 cm? Show how you know.
A rectangle has perimeter 36 cm. What could its area be? Draw pictures to show your thinking.
Draw or describe a shape that has perimeter 36 units and covers the greatest possible area. How would you convince a classmate it covers the greatest possible area?

As a whole group, share and discuss the findings. *(Allow about 10 minutes.)*

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4. Summarize the session. Depending upon the module this activity supplements, you may close by posing "springboard" questions or thoughts for upcoming *LfA* sessions.

   For example, if participants are to adapt or adopt assessment tasks, remind them that:

   > To determine what questions or tasks to ask of your students, ask yourself, *What do I want to know about my students' knowledge and understanding?* and *What will I do with the results?* Then, as you consider and create possible tasks, ask *Will the task(s) elicit useful responses so that I can assess my students' knowledge and understanding?* Just as instructional tasks provide students with opportunities to learn, tasks used for assessment must provide teachers with the opportunity to assess.

   You may also close the session by reminding participants of the following:

   > *Remember, with any one task, you create only a "snapshot" of a student's knowledge and understandings. To get accurate pictures of your students, you want the best snapshots possible and you need a large number and variety of them.*
   >
   > *The best of cameras with the best of lenses can take poor pictures if used incorrectly. But a poor camera with a poor lens can rarely take a good picture. Even if used with the best of intentions, poorly constructed or inappropriate tasks can create false pictures of students' knowledge and understanding. Choose your tools wisely and use them appropriately.*

Mathematics Multiple Choice Item

The perimeter of a square is 24 centimeters.

What is the area of that square?

A. 36 square cm

B. 48 square cm

C. 96 square cm

D. 576 square cm

E. I don't know.

SOURCE: National Center for Education Statistics, National Assessments of Educational Progress (NAEP), 1992

ALTERED ASSESSMENTS MATHEMATICS TASK HANDOUT

Analyze each item. What information might the item elicit about a student's knowledge and understanding?

The perimeter of a square is 36 centimeters. What is its area?

81 cm^2
144 cm^2
36 cm^2
1296 cm^2

What is the area of a square that has perimeter 36 cm? Show how you know.

A rectangle has perimeter 36 cm. What could its area be? Draw pictures to show your thinking.

Draw or describe a shape that has perimeter 36 units and covers the greatest possible area. How would you convince a classmate it covers the greatest possible area?

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Create an altered task of your own. What student information does it elicit?

FACILITATOR SUPPORT: SUPPLEMENTARY ACTIVITIES

Examining Resources to Support Alignment

A 45–60 MINUTE ACTIVITY

Overview

In this activity, participants use the *Alignment Model* as an organizing structure to examine three factors that influence how the alignment is accomplished. The factors are: ***Support Structures, Critical Issues,*** and ***Sources & Resources.*** For each curriculum component — intended, delivered, and achieved — participants identify how the factors support or hinder their efforts to create an aligned system.

Purpose

- To examine local policies, procedures, and resources relating to assessment, standards, and curriculum.
- To inform district staff (e.g., curriculum specialists, assessment specialists) of the resources and support that teachers need in order to align the *Intended*, *Delivered*, and *Achieved* curricula.

When to Use

This activity may be most valuable to teachers after they have worked with the *Alignment Model* and thought about what their *Intended*, *Delivered*, and *Achieved* curricula entail. It could become a concluding activity for any of the modules, but is probably most useful at the end of Module 3.

Materials

- Posters of each of the *Alignment Model* components (*Intended*, *Delivered*, and *Achieved* Curricula) on chart paper or poster board
- 3x5 Post-it™ notes or index cards in three colors *(one set of each color for every group of 3–4 participants)*
- Sentence strips, three each, in colors matching Post-it™ notes or index cards
- Chart markers
- Tape

FACILITATOR SUPPORT: SUPPLEMENTARY ACTIVITIES

EXAMINING RESOURCES TO SUPPORT ALIGNMENT — continued

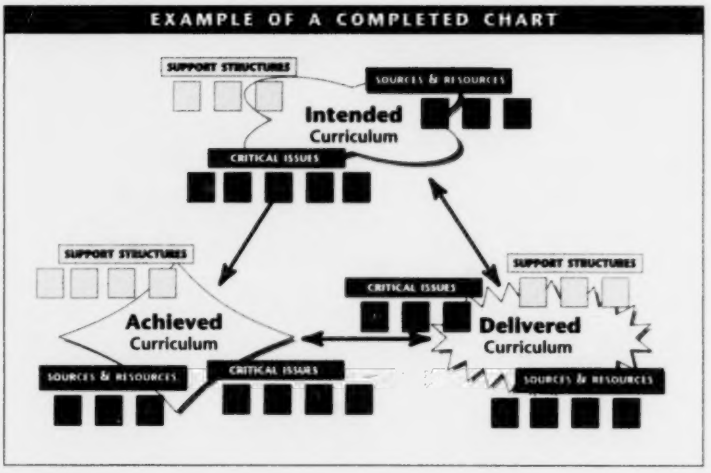
Preparation

Post the large shapes representing the components of the *Alignment Model.* Allow plenty of wall space around each component for contributed responses.

Use sentence strips to create headings for each of the discussion topics *(Support Structures, Critical Issues,* and *Sources & Resources).* Post these sets around each component. (Note: Use other factors, as appropriate to your situation.)

Facilitator Notes

When introducing the activity, emphasize that many factors influence all aspects of our curriculum. Refer to the *Alignment Model* with the three main components — *Intended, Delivered* and *Achieved* — used in *LfA* modules. Note that this activity involves identifying factors that can help us or hinder us in our alignment work. Participants will identify the critical issues, and also look at the resources and information that are available to support curriculum alignment. Be sure teachers apply this exercise to their own classroom, school, and district.



See page FS–21 for possible participant responses.

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FACILITATOR SUPPORT: SUPPLEMENTARY ACTIVITIES

EXAMINING RESOURCES TO SUPPORT ALIGNMENT — continued

1. Introduce the activity and refer to the suggested factors:

   - *Support Structures* (organizational)
   - *Critical Issues* (including beliefs about issues)
   - *Sources & Resources* (available and recommended)

   Begin with *Support Structures*. Ask, *What are some examples of district or school support for implementing the Intended curriculum?*

   Use Post-it™ notes (corresponding in color to the sentence strip for *Support Structures*) to record participant responses, recording one idea per note. Place the responses beneath the *Support Structures* strip. *(See diagram on previous page.)*

   Possible responses: District or county workshop on newly adopted standards; Mentor teacher to help me understand the Teacher's Guide to our adopted Math program; School grade-level meetings to determine Course of Study.

2. Form small groups (3-4) to identify *Support Structures* for both the *Delivered* and *Achieved* Curriculums. Ask participants to be as specific as possible. For example, if the district conducts workshops on a specific topic, describe the content of the workshops. *Have groups use the same color cards for all Support Structures responses.*

   Have each group report out, avoiding repetition from other groups, and post their notes by the appropriate component.

3. Continue working in small groups, using different color Post-it™ notes to record *Critical Issues* and *Sources & Resources.*

4. As a whole group, discuss one factor at a time, avoiding repetition. For each curriculum component, cluster the responses under the specified factor strip.

5. Summarize each factor, adding existing solutions, information about critical issues, additional resources available, and information about utilizing support structures.

6. Discuss possible next steps (e.g., resources, professional development possibilities, allocation of funds for materials, potential networks). Create an Action Plan to provide for participant needs.

FACILITATOR SUPPORT: SUPPLEMENTARY ACTIVITIES

EXAMINING RESOURCES TO SUPPORT ALIGNMENT — continued

Possible Responses to Examining Resources to Support Alignment:

INTENDED CURRICULUM

SUPPORT STRUCTURES

- District/county workshops on newly adopted standards.
- Framework developed by the District Curriculum Committee.
- School grade-level meetings to determine Course of Study.
- Mentor Teacher to help me understand the Teacher's Guide to our adopted program.

CRITICAL ISSUES

- Need staff development to translate standards into instruction.
- The teachers at my school don't agree on what the District Framework means.
- Parents don't understand that curriculum has changed since they were in school.
- I've never seen a Standards document!

SOURCES AND RESOURCES

- National Standards documents, District Standards document.
- School Course of Study document.
- Grade level benchmarks.
- Professional educational organization membership and publications.
- Web access to Standards and State Department of Education documents.

ACHIEVED CURRICULUM

SUPPORT STRUCTURES

- District workshop on designing assessment.
- Unit assessments designed by grade -level group.
- Assessment specialist from local university available for consultation.

CRITICAL ISSUES

- Need more information on the standardized test.
- How much class time can I justify teaching kids how to take standardized tests?
- Parents need information on how to interpret test results.

SOURCES AND RESOURCES

- End-of-unit assessments.
- Standardized test results.
- Bi-weekly quizzes.
- Student Portfolio ideas.

DELIVERED CURRICULUM

SUPPORT STRUCTURES

- Grade-level team at school site to share instructional strategies and develop lessons.
- Parents who use math in their jobs speak to class about real world applications and the importance of learning math.
- Mentor Teacher to observe my class and make suggestions.
- District Math Specialist provides professional development on adopted curriculum.

CRITICAL ISSUES

- Our adopted mathematics program doesn't include Problem-Based Learning, yet our District Framework encourages it.
- Need enough materials (textbooks, manipulatives, copier paper) for all students.
- Each 7th grade teacher plans his/her own syllabus — we need help aligning our classes!

SOURCES AND RESOURCES

- Education Technology grant for mathematics software.
- Replacement units from State Mathematics Council.
- PBS *Mathline®* Activities and listserve group.
- Instructional video math series on tape from District Resource Center.

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FACILITATOR SUPPORT: SUPPLEMENTARY ACTIVITIES

Hop To It! — Using the PBS *Mathline*® Video

PBS Mathline®

Overview of the Video Segments

Hop To It! is part of the PBS *Mathline*® Algebraic Thinking Math Project, and can be used to enhance each of the *LfA* modules.[1]

In the first segment of this video, Ana England, a middle school math teacher from Watsonville, CA, gives a modified version of a released eighth–grade math item from TIMSS to her students. She conducts individual interviews with students to determine their mathematical thinking and understanding *(approximately 16 minutes)*.

In the second segment, Ana designs an activity based on the results of those interviews, to provide additional practice in finding patterns and writing mathematical rules *(approximately 22 minutes)*.

Purpose

Students in the video are engaged with the same assessment item that is featured in Module 1. Observing students at work, hearing them talk about their mathematical thinking in relation to a familiar item, and seeing how the teacher uses this information to plan instruction helps participants examine *LfA* Guiding Questions:

- ***What mathematical thinking would students use on the assessment?***
- ***Are we assessing what we think we are assessing?***
- ***How do we link the assessment to instruction?***

When to Use

WITH MODULE 1

Using Segment 1 with Module 1

After participants have shared their strategies for solving Item 16, use segment 1 of the ***Hop To It!*** video to show how one teacher uses student interviews to gain an understanding of students' mathematical thinking.

[1] ***Hop To It!*** *is part of the PBS Mathline® Algebraic Thinking Math Project (ATMP). Check the Selected References section for more on the video series and ordering information.*

1. To segue into the video, consider the following script:

   Let's review what mathematical thinking you used to solve this problem. *(Refer to solutions participants shared in Module 1, Item 16.)*
   If you were using this item with an eighth–grade class, how could you assess what mathematical thinking students were using?

Segment 1 (approx. 16 minutes)

Ana England's eighth–grade Mathematics class in Watsonville, CA, is shown working on the assignment. The teacher is shown interviewing students. Stop the video after Ana explains what she learned about student thinking, just before the "frog activity."

2. After discussing their ideas, introduce the video:

   Now let's look at how Ana England, an eighth–grade mathematics teacher, uses a modified version of this item from TIMSS to understand students' mathematical thinking.

   During the video, pay special attention to the questions Ana asks her students to help them articulate the mathematical thinking they used on the item. How do their responses tell you what they know and can do in relation to the task?

3. Show the video but be sure to stop the video before the class starts the "frog activity."

   Begin the post–viewing discussion by using an open–ended prompt, such as Tell me what you saw.

   The following questions could then be discussed as a whole group, or assigned to table groups to discuss and then report back. If time is limited, assign a different question to each group. Be sure to allow ample reporting time so that ideas may be expanded upon.

   - What did you observe about student thinking in this video clip?
   - How does the student thinking in the video reflect or differ from our own thinking in approaching the problem?

- Both the written responses to the TIMSS item and subsequent student interviews provided the teacher with information about student understanding. Such information could be used to group the students to work together during the lesson. In such a situation, what strategy/strategies would you use for grouping students? Why?
- What are the strengths and weaknesses of using student writing to diagnose students' mathematical thinking and understanding?
- Only some of the students were interviewed. How would you choose which students to interview — interview only students who failed to answer the question correctly, include some students who answered correctly, etc.? What issues are involved in this decision?

Using Segment 2 with Module 1

If you have shown segment 1 earlier during this session, show the second segment prior to the Reflection section in the Module 1 script and after the discussion on student learning experiences. This portion of the video will illustrate how students receive extended practice in finding patterns and communicating their work.

Segment 2 (approx. 22 minutes)

Begin the video after Ana's explanation about student thinking. Students are shown working on the "frog activity," where they build upon the concepts underlying the assessment item in the previous segment.

1. To introduce the video, remind participants about the *LfA* Guiding Questions, especially, *How do we link the assessment with instruction?*

   Let's revisit Ana England's math class and look at an example of how she used what she learned from students after they worked on the TIMSS item. We will see students working in groups to identify patterns and write a rule. Look and listen carefully for ways Ana used the information she gathered on student thinking in segment 1 to design the activity we see in segment 2.

   Show segment 2 of the video which begins with the students working on the "frog activity."

2. Start the post–viewing discussion by having participants describe what they saw.

The following questions could then be discussed as a whole group, or assigned to table groups to discuss and then report back. Again, if time is limited, assign a different question to each group. Allow ample reporting time so that ideas may be expanded upon.

- While students are working in groups, what opportunities are there for assessing students? What techniques have worked for you?
- How can activities involving pattern recognition, extension, and generalization be structured to maximize the development of algebraic thinking?
- In this lesson, several groups derived different versions of a rule for the pattern they found. What are appropriate ways to convince students that such rules are or are not equivalent?
- What would this type of activity tell you about your students' ability to meet the standards?

WITH MODULE 2

Using Segment 1 with Module 2

Segment 1 of the video illustrates the use of student interviews as a method for collecting evidence of student understanding. Interviewing students is one example of using multiple measures for assessing students. Use the video prior to the Reflection section in the Module 2 script and after discussing questions such as, *Do we have enough evidence? Do we have the right evidence? How else might this tool be used?*

Using Segment 2 with Module 2

This segment can be used as a stand–alone, whether or not participants have viewed the first segment during Modules 1 or 2. Show segment 2 at the end of the module, following the Reflection section, to prepare participants for Module 3: Planning Instruction to Support Standards.

WITH MODULE 3

Using Segment 1 with Module 3

Prior to beginning this module, show segment 1 to review previous modules, and focus on *LfA*'s Guiding Questions:

- ***What mathematical thinking would students use on the assessment?***
- ***Are we assessing what we think we are assessing?***

Using Segment 2 with Module 3

If participants have viewed segment 1 during previous sessions, show segment 2 after "Modeling the Process" and before "Using the Process" to demonstrate how Ana England used her assessment of student understanding to plan the next activity for her class.

FACILITATOR SUPPORT: SELECTED REFERENCES

AMERICA COUNTS CHALLENGE, U.S. DEPARTMENT OF EDUCATION MATHEMATICS INITIATIVE

America Counts is a U.S. Department of Education initiative to help all students master challenging mathematics, including the foundations of algebra and geometry, by the end of 8th grade. With the National Science Foundation (NSF), the U.S. Department of Education has issued an action strategy to improve student achievement in mathematics by focusing efforts on six critical areas:

- Building public understanding of the mathematics our students must master to ensure their and our nation's prosperity and growth
- Improving the preparation and on–going professional development of mathematics teachers
- Providing a more challenging and engaging curriculum for all students
- Effective use of resources to support mathematics instruction
- Providing extra help and additional learning time for students who need it
- Utilizing research and assessment for continuous improvement.

For more information, visit the ED website at http://ed.gov/inits/Math/index.html or contact U.S. Department of Education, Mathematics Initiative, Office of Deputy Secretary, 400 Maryland Avenue, SW, Washington, DC 20202–0500.

BRYANT, DEBORAH AND MARK DRISCOLL. 1998. *EXPLORING CLASSROOM ASSESSMENT IN MATHEMATICS: A GUIDE FOR PROFESSIONAL DEVELOPMENT*, co–published by National Council of Teachers of Mathematics (NCTM) and the Association of Supervision and Curriculum Development (ASCD). 59pp. ISBN 0–875353–438–7 NCTM Item #672E1 $9.95

The authors present an assessment framework that helps teachers obtain accurate and relevant data about what students know and are able to do in mathematics. The framework guides teachers through steps including how to plan sound assessments, make better observations, and develop tasks and rubrics that yield results.

COUNCIL OF CHIEF STATE SCHOOL OFFICERS (CCSSO)

The Council of Chief State School Officers (CCSSO) is a nationwide, nonprofit organization representing chief education administrators. CCSSO works on behalf of the state agencies that have primary authority for education in each state.

For more information, visit the CCSSO website at http://www.ccsso.org/ or contact Council of Chief State School Officers, One Massachusetts Ave. NW, Suite 700, Washington, DC 20001–1431. (202) 408–5505.

Mathematics and Science Content Standards and Curriculum Frameworks: States' Progress on Development and Implementation 1997, Washington D.C.
Available at: *http://www.ccsso.org/standards–assessments.html*

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FACILITATOR SUPPORT: SELECTED REFERENCES

DRISCOLL, MARK AND DEBORAH BRYANT. 1998. LEARNING ABOUT ASSESSMENT, LEARNING THROUGH ASSESSMENT. National Academy Press. Available on the Web at *http://www.nap.edu* or contact National Academy Press, 2101 Constitution Avenue, NW, Lock Box 285, Washington, DC 20055. (800) 624–6242.

This book presents ways to assist teachers in learning about assessment and how student work can be used as a rich resource in professional development.

EISENHOWER NATIONAL CLEARINGHOUSE (ENC). 1998. *IDEAS THAT WORK: MATHEMATICS PROFESSIONAL DEVELOPMENT.* The Ohio State University. Call (800) USA–LEARN for copies, or contact ENC, 1929 Kenny Road, Columbus, OH 43210–1079. (800) 621–5785; info@enc.org and *http://www.enc.org*

This handbook provides fifteen strategies for professional development which can be used to expand the repertoire of professional development beyond typical experiences offered to teachers. The principles, design framework, and strategies for professional development described in this publication are elaborated in *Designing Professional Development for Teachers of Science and Mathematics* by Loucks–Horsley, S., P.W. Hewson, N. Love, and K.E. Stiles. 1998. Thousand Oaks, CA: Corwin Press.

GUSKEY, THOMAS R. FALL 1998. "THE AGE OF OUR ACCOUNTABILITY" IN *JOURNAL OF STAFF DEVELOPMENT,* National Staff Development Council, volume 19, number 4.

This reader–friendly article discusses why we must evaluate professional development activities, the importance and difficulty of gathering evidence and guidelines for doing so.

THE NATIONAL ASSESSMENT OF EDUCATIONAL PROGRESS — NAEP: THE NATION'S REPORT CARD

The *National Assessment of Educational Progress* (NAEP) is mandated by Congress to survey the educational accomplishments of U.S. students and to monitor changes in those accomplishments. For over 27 years, NAEP has been collecting data with the aim of providing accurate and useful information to educators and policy makers. NAEP assesses student achievement at grades 4, 8, and 12 in various subject areas, including mathematics, science, reading, writing, history/geography, and other fields and provides results for 40 or more states. NAEP has been tracking U.S. progress in academic achievement since 1969 and began providing state–level as well as national mathematics achievement results in 1990. Mathematics assessments were conducted in 1992 and 1996 and are next scheduled for the year 2000.

For more information, visit the NAEP website at http://nces.ed.gov/ or contact National Center for Education Statistics, 555 New Jersey Ave., NW. Washington, DC 20208–5653. (202) 219–1690.

FACILITATOR SUPPORT: SELECTED REFERENCES

The NAEP Guide: A Description of the Content and Methods of the 1994 and 1996 Assessments

The purpose of this NAEP Guide is to provide an overview of the scope of the project and to increase the understanding of the philosophical approach, procedures, analysis, and psychometric underpinnings of the NAEP design. This Guide also acquaints readers with NAEP's informational resources, demonstrates the appropriateness of NAEP's design to its role as indicator of national educational achievement, and describes some of the methods used in the 1994 and 1996 assessments.
Available at *http://nces.ed.gov/pubs/97586.html*

NAEP Released Mathematics Items

Actual test questions from the assessment, both multiple–choice and constructed–response questions, are available on the Web at

http://nces.ed.gov/nationsreportcard/sampleq/mathrel.shtml

NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS (NCTM)

The National Council of Teachers of Mathematics (NCTM) is a professional organization for mathematics educators. The mission of NCTM is to provide vision and leadership in improving the teaching and learning of mathematics so that every student is ensured an equitable standards–based mathematics education and every teacher of mathematics is ensured the opportunity to grow professionally.

For more information, visit the NCTM website at http://www.nctm.org or contact: National Council of Teachers of Mathematics (NCTM), 1906 Association Drive, Reston, VA 20191–1593. (703) 620–9840; fax (703) 476–2970

NCTM Curriculum and Evaluation Standards for School Mathematics. 1989.

The 54 standards describe the curriculum in terms of content priority and emphasis in four groups: one set each for grades K–4, 5–8, and 9–12, and one set for evaluating math programs and student achievement. Package price and quantity discount apply. Now also available in Spanish. 1989. 258 pp. ISBN 0–87353–273–2 #396E1 $25.00

Principles and Standards for School Mathematics

This document will be finalized in 2000. An electronically enhanced version of the print draft including hyperlinks and multimedia examples is available at *http://www.nctm.org.* For a hard copy of the draft, contact NCTM at the address above.

FACILITATOR SUPPORT: SELECTED REFERENCES

PBS *Mathline*® is a teacher resource service of public television utilizing the power of telecommunications and video to provide resources and services to teachers of mathematics grades, K–12. Through participation in *Mathline*, teachers collaborate to make important decisions about their teaching.

A new professional development program, the Algebraic Thinking Math Project (ATMP), has as its main purpose the promotion of thinking, dialogue and growth among teachers in grades three through eight on the topic of developing algebraic thinking in students. This project consists of: a series of video lessons which allow teachers to make "virtual visits" to classrooms where teachers and students are engaged in NCTM Standards–based instruction; printed lesson guides; and online learning communities which provide teachers with a small, focused web–based conference area. The video set includes an overview on "algebraic thinking" — what it means, why it is important, what research tells us about it, and what it looks like in different classroom settings.

For more information about Mathline, visit the website at http://www.pbs.org/teachersource/math/middle.html

REGIONAL EDUCATIONAL LABORATORIES. 1998. *IMPROVING CLASSROOM ASSESSMENT: A TOOLKIT FOR PROFESSIONAL DEVELOPERS (TOOLKIT 98),* Northwest Regional Educational Laboratory, Portland, OR.

This ready–to–use toolkit for professional developers offers two volumes of materials: one with background text and professional development training activities; the other containing supplemental resources, including sample assessment items, student work and readings.

For more information, visit the NWREL website at http://www.nwrel.org.

THE THIRD INTERNATIONAL MATHEMATICS AND SCIENCE STUDY (TIMSS)

The Third International Mathematics and Science Study (TIMSS) is the largest and most ambitious international study of student achievement ever conducted. In 1994–95, it was conducted at three grade–level bands (3/4, 7/8, and the final year of secondary school) in 41 countries and more than 30 languages. Students were tested in mathematics and science, and extensive information about the teaching and learning of mathematics and science was collected. Altogether, TIMSS tested and gathered contextual data for more than half a million students and administered questionnaires to thousands of teachers and school principals. Also, TIMSS investigated the mathematics and science curricula of the participating countries. The TIMSS results were released in 1996 and 1997 in a series of reports, providing valuable information about mathematics and science instruction and student achievement.

FACILITATOR SUPPORT: SELECTED REFERENCES

In addition, a repeat of TIMSS (TIMSS–R) will be conducted at the eighth grade in 1999. This provides countries that participated in TIMSS in 1994–95 the opportunity to monitor trends in mathematics and science achievement at the eighth grade and allows countries that did not participate in TIMSS the opportunity to compare with international benchmarks. Release of the TIMSS–R results is planned for 2001.

For more information, visit the TIMSS website at http://www.csteep.bc.edu/timss or contact TIMSS International Study Center, Center for the Study of Testing, Evaluation, and Educational Policy (CSTEEP), Campion Hall 323, Boston College, Chestnut Hill, MA 02467. (617) 552–4521; fax (617) 552–8419; email: timss@bc.edu

TIMSS Mathematics Items, Released Set for Population 2 (Seventh and Eighth Grades), $20.00 (prepaid). Available at: *http://www.csteep.bc.edu/TIMSS1/Items.html* or order from CSTEEP at the address above.

TIMSS Related Reports

The International Association for the Evaluation of Educational Achievement (1996). *Mathematics Achievement in the Middle School Years: IEA's Third International Mathematics and Science Study,* $18; through GPO, stock #065–000–01023–2; contact Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250–7954; (202) 512–1800; fax (202) 512–2250.

Schmidt, William H.; McKnight, Curtis C.; and Raizen, Senta A. (1996). *A Splintered Vision: An Analysis of U.S. Mathematics and Science Curricula, (1997).* Boston, MA: Kluwer Academic Publishers.
This book enunciates the argument that math and science curricula in U.S. schools suffer from a lack of focus. The authors contend that in their effort to canvas as many topics as possible, both teachers and textbook publishers fail to delve into the most important subjects with sufficient depth. 176 pp. Hardback ISBN: 0-7923-4440-5, $87.00; Paperback ISBN: 0-7923-4441-3, $49.00.

To order, contact: Kluwer Academic Publishers Group, Order Department, P.O. Box 358, Accord Station, Hingham, MA 02018-0358; Telephone: (781) 871-6600; Fax (781) 871-6528; Email: kluwer@wkap.com

The URL for the executive summary is: http://ustimss.msu.edu/splintrd.htm

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FACILITATOR SUPPORT: SELECTED REFERENCES

Attaining Excellence: A TIMSS Resource Kit
The multimedia *Resource Kit* includes four modules: *U.S. Education, Student Achievement, Teaching,* and *Curriculum.* The modules contain reports, videotapes of classroom teaching, guides for discussion, and presentation materials for using the information. All modules are designed to use national and international studies such as the Third International Mathematics and Science Study (TIMSS), the National Assessment of Educational Progress (NAEP), and findings of similar and related research to help inform our understanding of instructional practice and student achievement in the United States as compared to other countries. Collectively, the modules suggest how the information generated from TIMSS can promote identification of the strengths and weaknesses of education at all levels of the education enterprise in the United States and to make reasonable comparisons with other countries that may be our economic competitors. ($94, GPO stock #065-000-0103-5)

Attaining Excellence: TIMSS as a Starting Point to Examine US Mathematics Assessments is a new companion to the *TIMSS Resource Kit.* This Assessment Module is designed to help State and local educators compare their eighth-grade mathematics assessment frameworks and curricula with national and international benchmarks. The module provides a comparison of NAEP and TIMSS mathematical assessment frameworks using actual test items to show how the geometry and algebra portions of the frameworks are articulated in the form of test questions across grades 4, 8, and 12. The Assessment Module cannot be purchased as part of *Attaining Excellence: A TIMSS Resource Kit.* It is only sold as a separate item, however, it is designed to fit conveniently into the Kit. ($33, GPO stock #065-000-01222-7)

To order *Attaining Excellence: A TIMSS Resource Kit* or *Attaining Excellence: TIMSS as a Starting Point to Examine Mathematics Assessments*, contact Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954; (202)512-1800; fax (202)512-2250.

The *Resource Kit* can also be purchased through NCTM as Item #668E1. Contact NCTM at 1906 Association Drive, Reston, VA 20191-1593; (800)235-7566; fax (703)476-2970.

APPENDIX A

Special Notes on *LfA* Materials

Posters

The preparation guides for each of the *LfA* modules state that posters should be made of the *Alignment Model* and *Guiding Questions* black line masters. We suggest that you enlarge the black line masters to at least 25" by 30" through use of a chart maker or by copying them onto poster–size paper. If you are planning a series of sessions using *LfA* materials, laminating the posters will preserve them for repeated use.

LfA materials stress the importance of aligning assessment, instruction, and standards — the achieved, delivered, and intended curricula. The *Alignment Model* conveys this message visually and can be a useful reference during various segments of the sessions.

Each module has been designed to address the four *Guiding Questions*. Agendas and scripts use varied combinations of these questions as major headings. Displaying the questions in a prominent place helps to focus attention on the purpose of the activities.

In Module 2, participants will be using a *Standards/Assessment Matrix*. This visual aid needs to be large enough to be seen by all participants. The black line masters can be enlarged to 25" by 30" size or copied by hand on butcher paper. Each cell within the matrix needs to be large enough to accommodate several 1.5 x 2 Post-it™ notes.

Standards

Facilitating an orientation to standards and an understanding of how they can be translated into practice is a major goal for *LfA*. The materials are designed so that you can use your own standards or those that we provide. Before introducing your local standards, consider using the optional reference material in the *LfA* module, so that participants' initial focus is on learning how to use the *LfA* tools.

In Module 1 we suggest that you duplicate a full set of mathematics standards for each participant. If you do not choose to use your own local standards, we have provided black line masters of the 1989 NCTM *Curriculum and Evaluation Standards for School Mathematics*. Duplicate the standards, and then separate the major sections into cards or strips that can be sorted and discussed by participants. Working with individual standards allows participants to delineate the mathematics content to be learned.

LEARNING FROM ASSESSMENT

MODULE 1

Aligning Assessment to Standards

PURPOSE:

- to become familiar with a given set of standards;
- to discuss interpretations of those standards;
- to develop a "critical eye" for selecting or developing assessment items; and
- to learn a process for aligning assessment to standards.

LEARNING FROM ASSESSMENT

MODULE 2

Collecting Standards–based Evidence

PURPOSE:

- to look carefully at assessment tools to determine what they actually ask of students;
- to use standards as a guide for creating assessments;
- to build an assessment framework; and
- to look for gaps and overlaps in assessments.

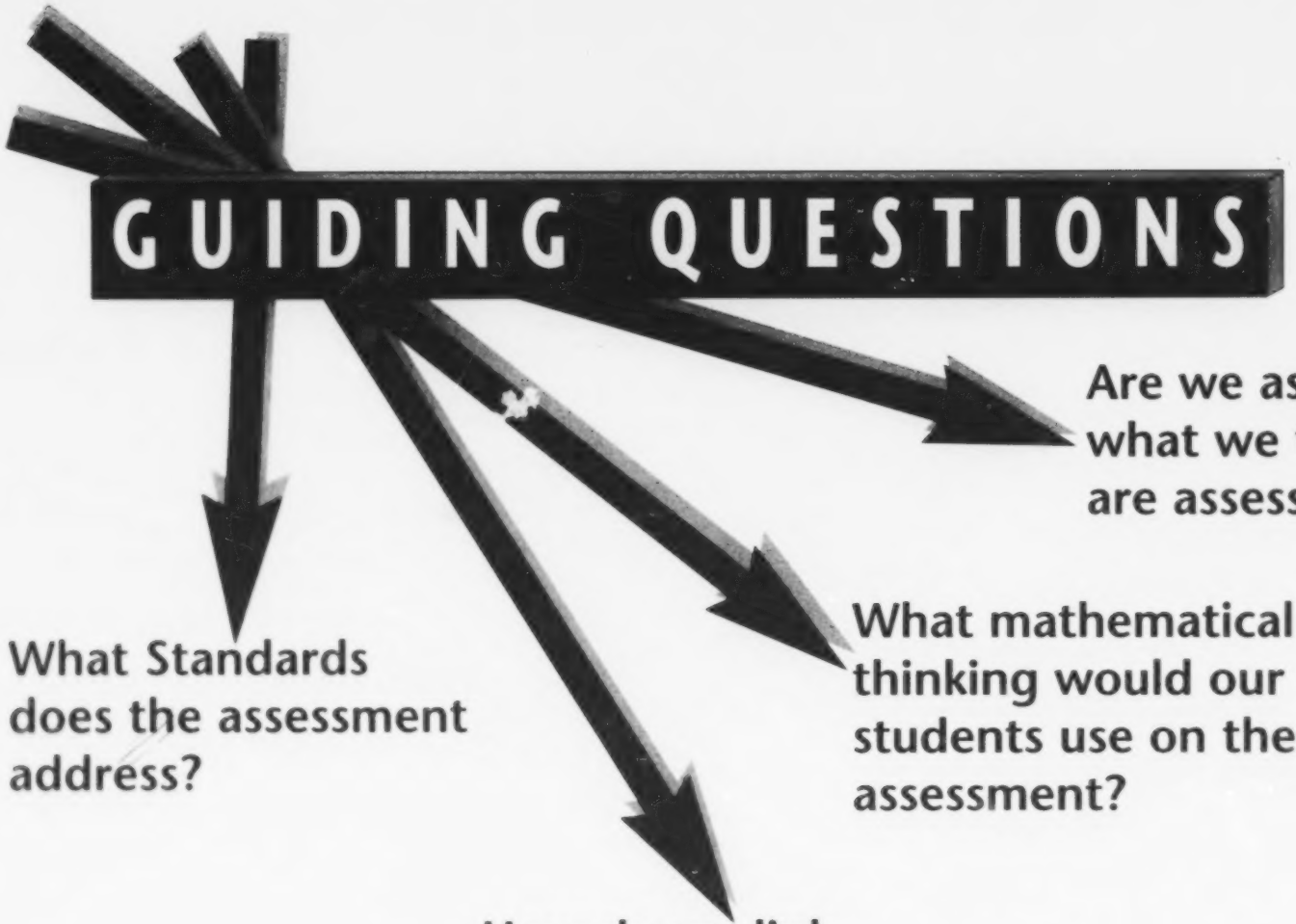
LEARNING FROM ASSESSMENT

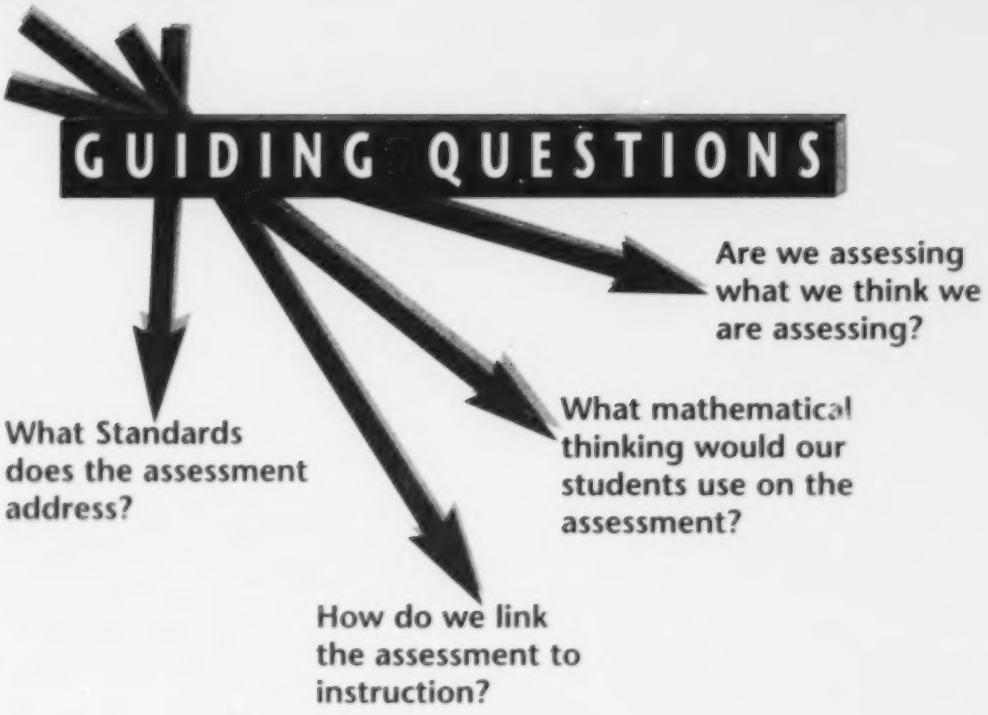
MODULE 3

Planning Instruction to Support Standards

PURPOSE:

- to learn to use a standards–based instructional planning model;
- to identify required learning experiences based on standards; and
- to match instructional strategies and materials to identified student learning experiences.


GUIDING QUESTIONS
Are we assessing what we think we are assessing?
What mathematical thinking would our students use on the assessment?
How do we link the assessment to instruction?
What Standards does the assessment address?


GUIDING QUESTIONS
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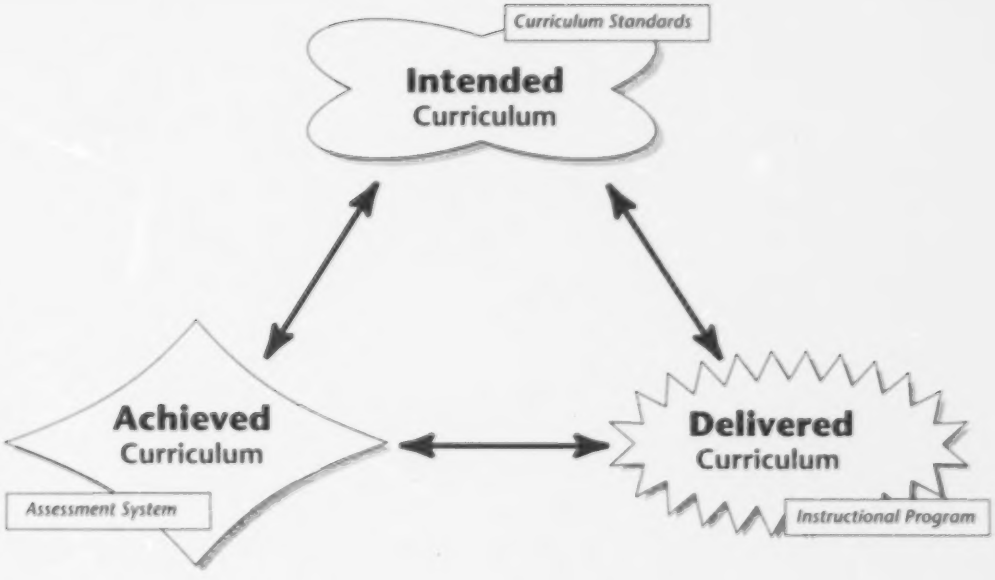
How do we link the assessment to instruction?

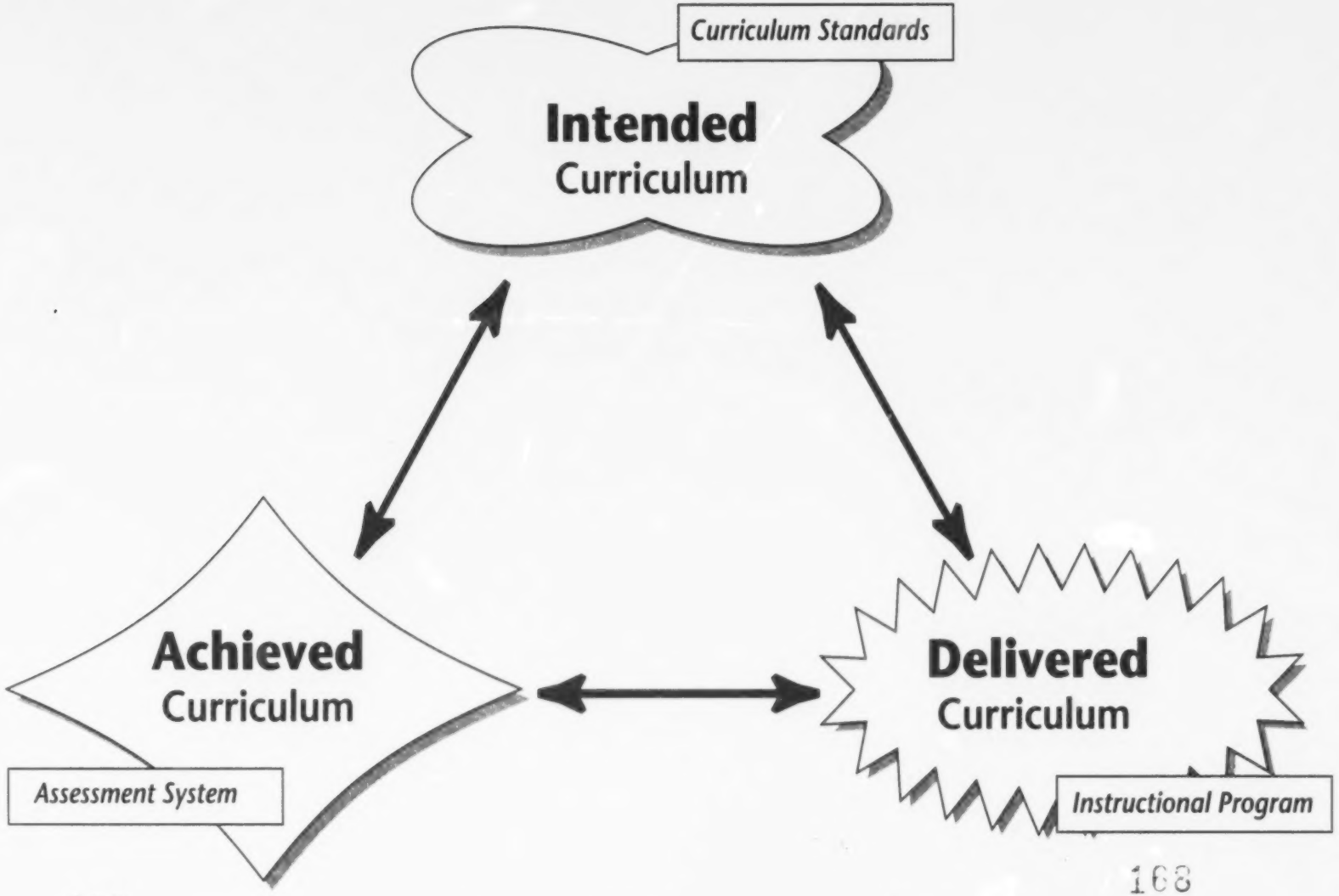
ALIGNMENT MODEL



LARGE–SCALE ASSESSMENT

What thoughts come to mind?

ALIGNMENT MODEL



"Systems that are aligned — curriculum, teaching, and assessment — have a greater chance of success for students.

Changes in any one of these three essential aspects of mathematics education reform without corresponding and supportive changes in the others will surely lead to a failure to reach the goal of a powerful mathematics education for all students.

Tinkering with components of the system rather than coordinated change is not likely to work, and it might work to the disadvantage of students."

Glenda Lappan, President NCTM
NCTM News Bulletin (October 1998)

ITEM 16

Here is a sequence of three similar triangles. All of the small triangles are congruent.

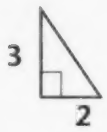


Figure 1

Figure 2

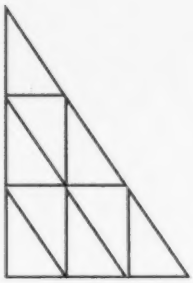


Figure 3

a. Complete the chart by finding how many small triangles make up each figure.

Figure	*Number of small triangles*
1	1
2	
3	

b. The sequence of similar triangles is extended to the 8th Figure. How many small triangles would be needed for Figure 8?

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WHAT MATHEMATICAL THINKING WOULD OUR STUDENTS USE ON THE ASSESSMENT?

1 Use the large chart paper and markers.

2 Make a poster to show what you expect an 8th grader would do on the item.

3 Post your finished work with others showing similar strategies.

Standard 1: Mathematics as Problem Solving

In grades 5–8, the mathematics curriculum should include numerous and varied experiences with problem solving as a method of inquiry and application so that students can —

- *(1a)* use problem-solving approaches to investigate and understand mathematical content;
- *(1b)* formulate problems for situations within and outside mathematics;
- *(1c)* develop and apply a variety of strategies to solve problems, with emphasis on multistep and nonroutine problems;
- *(1d)* verify and interpret results with respect to the original problem situation;
- *(1e)* generalize solutions and strategies to new problem situations;
- *(1f)* acquire confidence in using mathematics meaningfully.

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Standard 2: Mathematics as Communication

In grades 5–8, the study of mathematics should include opportunities to communicate so that students can —

- *(2a)* model situations using oral, written, concrete, pictorial, graphical, and algebraic methods;
- *(2b)* reflect on and clarify their own thinking about mathematical ideas and situations;
- *(2c)* develop common understandings of mathematical ideas, including the role of definitions;
- *(2d)* use the skills of reading, listening, and viewing to interpret and evaluate mathematical ideas;
- *(2e)* discuss mathematical ideas and make conjectures and convincing arguments;
- *(2f)* appreciate the value of mathematical notion and its role in the development of mathematical ideas.

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Standard 3: Mathematics as Reasoning

In grades 5–8, reasoning shall permeate the mathematics curriculum so that students can —

- *(3a)* recognize and apply deductive and inductive reasoning;
- *(3b)* understand and apply reasoning processes, with special attention to spatial reasoning and reasoning with proportions and graphs;
- *(3c)* make and evaluate mathematical conjectures and arguments;
- *(3d)* validate their own thinking;
- *(3e)* appreciate the pervasive use and power of reasoning as a part of mathematics.

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Standard 4: Mathematical Connections

In grades 5–8, the mathematics curriculum should include the investigation of mathematical connections so that students can —

(4a) see mathematics as an integrated whole;

(4b) explore problems and describe results using graphical, numerical, physical, algebraic, and verbal mathematical models or representations;

(4c) use a mathematical idea to further their understanding of other mathematical ideas;

(4d) apply mathematical thinking and modeling to solve problems that arise in other disciplines, such as art, music, psychology, science, and business;

(4e) value the role of mathematics in our culture and society.

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Standard 5: Number and Number Relationships

In grades 5–8, the mathematics curriculum should include the continued development of number and number relationships so that students can —

(5a) understand, represent, and use numbers in a variety of equivalent forms (integer, fraction, decimal, percent, exponential, and scientific notation) in real–world and mathematical problem situations;

(5b) develop number sense for whole numbers, fractions, decimals, integers, and rational numbers;

(5c) understand and apply ratios, proportions, and percents in a wide variety of situations;

(5d) investigate relationships among fractions, decimals, and percents;

(5e) represent numerical relationships in one– and two–dimensional graphs.

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Standard 6: Number Systems and Number Theory

In grades 5–8, the mathematics curriculum should include the study of number systems and number theory so that students can —

(6a) understand and appreciate the need for numbers beyond the whole numbers;

(6b) develop and use order relations for whole numbers, fractions, decimals, integers, and rational numbers;

(6c) extend their understanding of whole number operations to fractions, decimals, integers, and rational numbers;

(6d) understand how the basic arithmetic operations are related to one another;

(6e) develop and apply number theory concepts (e.g., primes, factors, and multiples) in real–world and mathematical problem situations.

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Standard 7: Computation and Estimation

In grades 5–8, the mathematics curriculum should develop the concepts underlying computation and estimation in various contexts so that students can —

(7a) compute with whole numbers, fractions, decimals, integers, and rational numbers;

(7b) develop, analyze, and explain procedures for computation and techniques for estimation;

(7c) develop, analyze, and explain methods for solving proportions;

(7d) select and use an appropriate method for computing from among mental arithmetic, paper-and-pencil, calculator, and computer methods;

(7e) use computation, estimation, and proportions to solve problems;

(7f) use estimation to check the reasonableness of results.

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Standard 8: Patterns and Functions

In grades 5–8, the mathematics curriculum should include explorations of patterns and functions so that students can —

(8a) describe, extend, analyze, and create a wide variety of patterns;

(8b) describe and represent relationships with tables, graphs, and rules;

(8c) analyze functional relationships to explain how a change in one quantity results in a change in another;

(8d) use patterns and functions to represent and solve problems.

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Standard 9: Algebra

In grades 5–8, the mathematics curriculum should include explorations of algebraic concepts and processes so that students can —

(9a) understand the concepts of variable, expression, and equation;

(9b) represent situations and number patterns with tables, graphs, verbal rules, and equations and explore the interrelationships of these representations;

(9c) analyze tables and graphs to identify properties and relationships;

(9d) develop confidence in solving linear equations using concrete, informal, and formal methods;

(9e) investigate inequalities and nonlinear equations informally;

(9f) apply algebraic methods to solve a variety of real-world and mathematical problems.

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Standard 10: Statistics

In grades 5–8, the mathematics curriculum should include exploration of statistics in real-world situations so that students can —

(10a) systematically collect, organize, and describe data;

(10b) construct, read, and interpret tables, charts, and graphs;

(10c) make inferences and convincing arguments that are based on data analysis;

(10d) evaluate arguments that are based on data analysis;

(10e) develop an appreciation for statistical methods as powerful means for decision making.

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Standard 11: Probability

In grades 5–8, the mathematics curriculum should include explorations of probability in real-world situations so that students can —

(11a) model situations by devising and carrying out experiments or simulations to determine probabilities;

(11b) model situations by constructing a sample space to determine probabilities;

(11c) appreciate the power of using a probability model by comparing experimental results with mathematical expectations;

(11d) make predictions that are based on experimental or theoretical probabilities;

(11e) develop an appreciation for the pervasive use of probability in the real world.

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Standard 12: Geometry

In grades 5–8, the mathematics curriculum should include the study of the geometry of one, two, and three dimensions in a variety of situations so that students can —

(12a) identify, describe, compare, and classify geometric figures;

(12b) visualize and represent geometric figures with special attention to developing spatial sense;

(12c) explore transformations of geometric figures;

(12d) represent and solve problems using geometric models;

(12e) understand and apply geometric properties and relationships;

(12f) develop an appreciation of geometry as a means of describing the physical world.

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Standard 13: Measurement

In grades 5–8, the mathematics curriculum should include extensive concrete experiences using measurement so that students can —

(13a) extend their understanding of the process of measurement;

(13b) estimate, make, and use measurements to describe and compare phenomena;

(13c) select appropriate units and tools to measure to the degree of accuracy required in a particular situation;

(13d) understand the structure and use of systems of measurement;

(13e) extend their understanding of the concepts of perimeter, area, volume, angle measure, capacity, and weight and mass;

(13f) develop the concepts of rates and other derived and indirect measurements;

(13g) develop formulas and procedures for determining measures to solve problems.

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WHAT STANDARDS DOES THE ASSESSMENT ADDRESS?

1 Work with your partner.

2 Use the Standards and quickly review the major headings; eliminate those that do not apply.

3 Examine remaining Standards; identify which components are addressed.

Is the alignment between the item and the Standard strong enough for the "eye" test?

If

YES **include** the Standard

NO **modify** the item
or
exclude the Standard

ARE WE ASSESSING WHAT WE THINK WE ARE ASSESSING?

1. Work in a group of four.
2. Select one or more of the listed Standards.
3. Modify the assessment item to produce better alignment with the selected Standard(s).

HOW DO WE LINK THE ASSESSMENT TO INSTRUCTION?

1. Work in a group of four.
2. Identify the broad learning experiences required for student success on this item.
3. Record each idea on a separate "sticky."
4. Post your responses on the chart.

Can we accomplish all of this in the 8th grade?

What should this look like at various grades?

What can we do prior to 8th grade?

AFTERTHOUGHTS

- Something I am thinking about differently is .....

- Because of what I learned today, something I will do differently is....

EUCLIDEAN UNIFIED SCHOOL DISTRICT

Mathematics Standards for Grades 6–8

GEOMETRY, SPATIAL SENSE, AND MEASUREMENT

Mathematics instructional programs should include attention to geometry, spatial sense, and measurement so that by the end of the eighth grade all students can —

a) analyze characteristics and properties of two– and three–dimensional geometric objects;

b) select and use different representational systems, including coordinate geometry and graph theory;

c) recognize the usefulness of transformations and symmetry in analyzing mathematical situations;

d) use visualization and spatial reasoning to solve problems both within and outside of mathematics;

e) understand attributes, units, and systems of measurement;

f) apply a variety of techniques, tools, and formulas for determining measurements.

Adapted from: NCTM *Principles and Standards for School Mathematics: Discussion Draft* (October 1998)

EUCLIDEAN UNIFIED SCHOOL DISTRICT

Mathematics Standards for Grades 6–8

PATTERNS, FUNCTIONS, AND ALGEBRA

Mathematics instructional programs should include attention to patterns, functions, symbols, and models so that by the end of the eighth grade all students can —

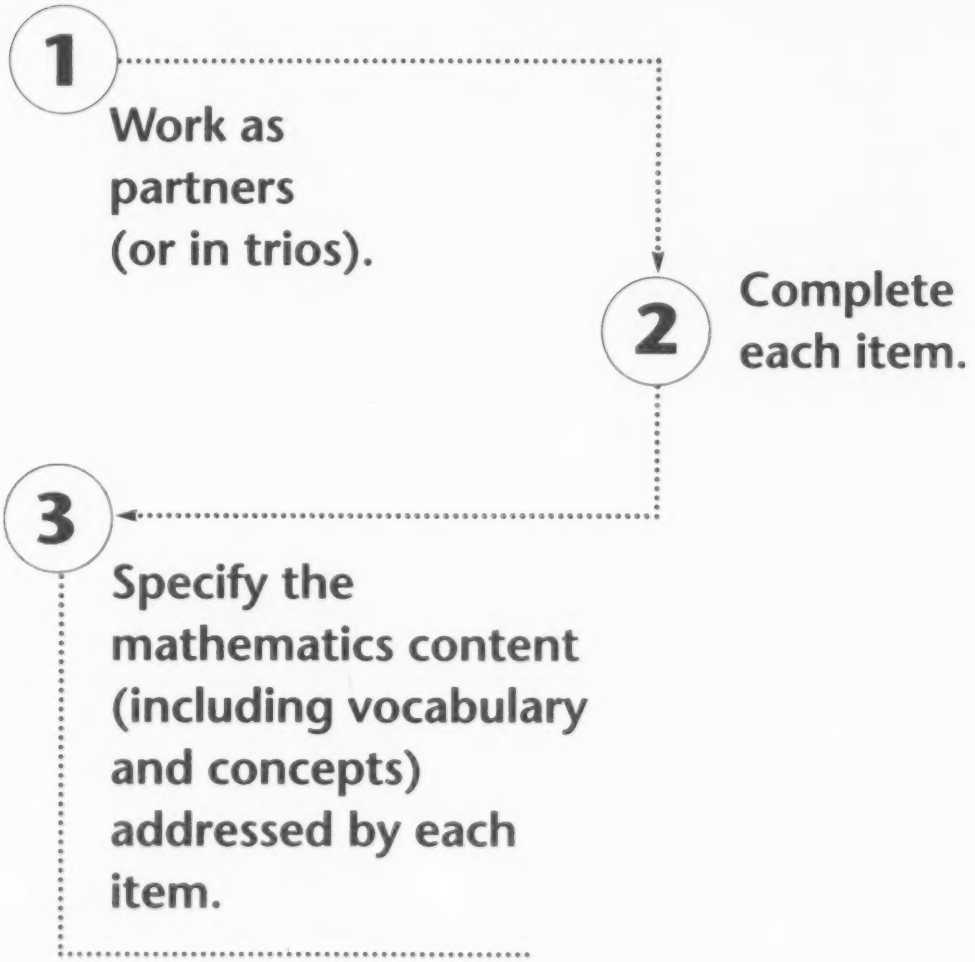
a) understand various types of patterns and functional relationships;

b) use symbolic forms to represent and analyze mathematical situations and structures;

c) use mathematical models and analyze change in both real and abstract contexts.

Adapted from: NCTM *Principles and Standards for School Mathematics: Discussion Draft* (October 1998)

WHAT MATHEMATICAL THINKING WOULD OUR STUDENTS USE ON THE ASSESSMENT?


1
Work as partners (or in trios).
2
Complete each item.
3
Specify the mathematics content (including vocabulary and concepts) addressed by each item.

ITEM 1

A straight line on a graph passes through the points (3, 2) and (4, 4). Which of these points also lies on the line?

A. (1, 1)
B. (2, 4)
C. (5, 6)
D. (6, 3)
E. (6, 5)

What is the Mathematical Content?

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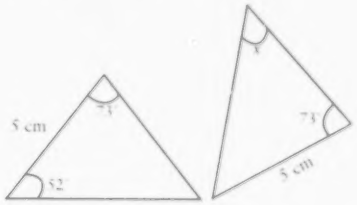
ITEM 3

These triangles are congruent.
The measures of some of the sides and angles of the triangles are shown.

What is the value of x?



A. 52
B. 55
C. 65
D. 73
E. 75

What is the Mathematical Content?

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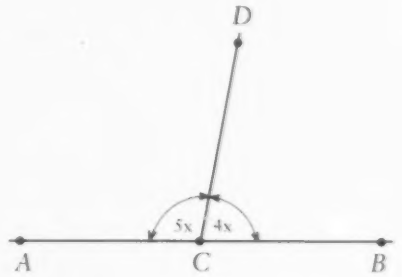
ITEM 5

In this figure AB is a straight line.



What is the measure, in degrees, of angle BCD ?

A. 20
B. 40
C. 50
D. 80
E. 100

What is the Mathematical Content?

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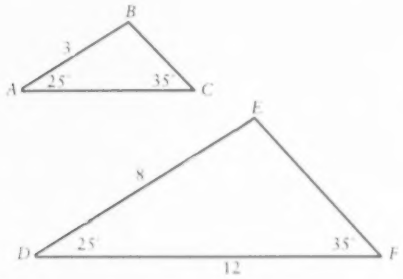
ITEM 7

Triangles ABC and DEF are similar triangles.



What is the length of side AC ?

A. 2
B. 4
C. 4.5
D. 5.5
E. 32

What is the Mathematical Content?

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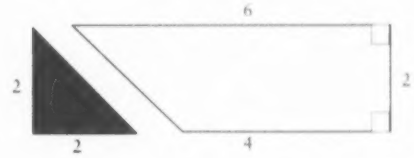
ITEM 9

How many triangles of the shape and size of the shaded triangle can the trapezoid below be divided into?



A. Three
B. Four
C. Five
D. Six

What is the Mathematical Content?

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ITEM 12

The length of a rectangle is 6 cm, and its perimeter is 16 cm. What is the area of the rectangle in square centimeters?

Answer: _____

What is the Mathematical Content?

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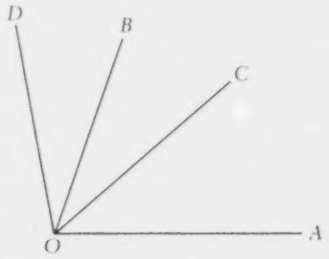
ITEM 14

In the figure, the measure of $\angle AOB$ is 70°, the measure of $\angle COD$ is 60°, and the measure of $\angle AOD$ is 100°.



What is the measure of $\angle COB$?

Answer: _____

What is the Mathematical Content?

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ITEM 16

Here is a sequence of three similar triangles. All of the small triangles are congruent.

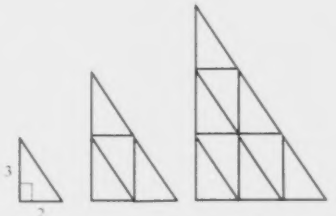

Figure 1 *Figure 2* *Figure 3*

a. Complete the chart by finding how many small triangles make up each figure.

Figure	*Number of small triangles*
1	1
2	
3	

b. The sequence of similar triangles is extended to the 8th Figure. How many small triangles would be needed for Figure 8?

What is the Mathematical Content?

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ITEM 17

The figure consists of 5 squares of equal size. The area of the whole figure is 405 cm^2.

Find the area of one square.

Answer:

_____ square centimeters

Find the length of the side of one square.

Answer:

_____ centimeters

Find the perimeter of the whole figure in centimeters.

Answer:

_____ centimeters

What is the Mathematical Content?

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ITEM 19

Two boxes of square-shaped cardboard pieces are available to make a larger pattern. There are 4 small squares in each piece.

All pieces in Box 1 look like

All pieces in Box 2 look like

In the required pattern, for every piece from Box 2 there are 2 pieces from Box 1.

a. If 60 pieces from Box 2 are used in the required pattern, how many pieces will be needed altogether?

Answer: _____

b. What fraction of the small squares in the required pattern will be black?

Answer: _____

What is the Mathematical Content?

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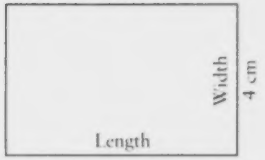
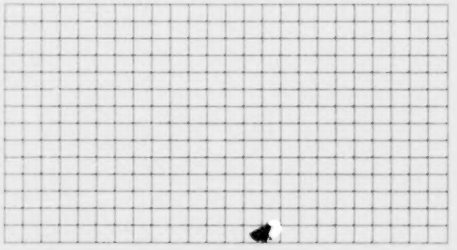
ITEM 20



a. In the space below, draw a new rectangle whose length is one and a half times the length of the rectangle above, and whose width is half the width of the rectangle above. Show the length and width of the new rectangle in centimeters on the figure.



b. What is the ratio of the area of the new rectangle to the area of the first one? Show your work.

What is the Mathematical Content?

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ITEM 21

From any vertex of a 4-sided polygon, 1 diagonal can be drawn.
From any vertex of a 5-sided polygon, 2 diagonals can be drawn.
From any vertex of a 6-sided polygon, 3 diagonals can be drawn.
From any vertex of a 7-sided polygon, 4 diagonals can be drawn.

How many diagonals can be drawn from any vertex of a 20-sided polygon?

Answer: _____

What is the Mathematical Content?

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996, Grade 8 Mathematics. ***Original Item Number: Block S2M3, Item 10***

ITEM 1

A straight line on a graph passes through the points (3, 2) and (4, 4). Which of these points also lies on the line?

A. (1, 1)
B. (2, 4)
C. (5, 6)
D. (6,3)
E. (6, 5)

—What is the Mathematical Content?—

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ITEM 2

The table represents a relation between x and y.

What is the missing number in the table?

A. 2
B. 3
C. 4
D. 5
E. 6

x	y
1	1
2	?
4	7
7	13

—What is the Mathematical Content?—

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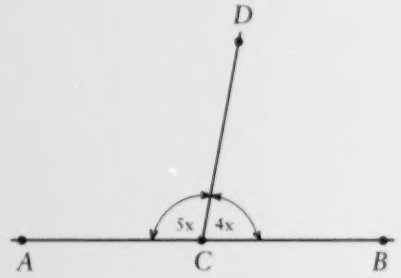
ITEM 5

In this figure AB is a straight line.



What is the measure, in degrees, of angle BCD ?

A. 20
B. 40
C. 50
D. 80
E. 100

—What is the Mathematical Content?—

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ITEM 6

Jan had a bag of marbles. She gave half of them to James and then a third of the marbles still in the bag to Pat. She then had 6 marbles left. How many marbles were in the bag to start with?

A. 18
B. 24
C. 30
D. 36

What is the Mathematical Content?

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ITEM 8

Juan has 5 fewer hats than Maria, and Clarissa has 3 times as many hats as Juan. If Maria has n hats, which of these represents the number of hats that Clarissa has?

A. $5 - 3n$
B. $3n$
C. $n - 5$
D. $3n - 5$
E. $3(n - 5)$

What is the Mathematical Content?

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ITEM 10

Which of the following ordered pairs (x, y) is a solution to the equation $2x - 3y = 6$?

A. (6, 3)
B. (3, 0)
C. (3, 2)
D. (2, 3)
E. (0, 3)

What is the Mathematical Content?

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996, Grade 8 Mathematics. ***Original Item Number: Block S2M3, Item 8***

ITEM 12

The length of a rectangle is 6 cm, and its perimeter is 16 cm. What is the area of the rectangle in square centimeters?

Answer: _____

—What is the Mathematical Content?

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ITEM 16

Here is a sequence of three similar triangles. All of the small triangles are congruent.

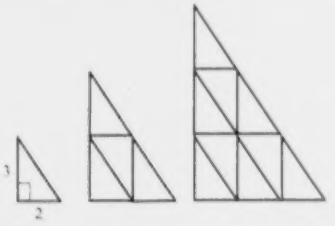

Figure 1 *Figure 2* *Figure 3*

a. Complete the chart by finding how many small triangles make up each figure.

Figure	*Number of small triangles*
1	1
2	
3	

b. The sequence of similar triangles is extended to the 8th Figure. How many small triangles would be needed for Figure 8?

—What is the Mathematical Content?

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ITEM 18

There are 54 kilograms of apples in two boxes. The second box of apples weighs 12 kilograms more than the first. How many kilograms of apples are in each box? Show your work.

—What is the Mathematical Content?

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ITEM 3

These triangles are congruent. The measures of some of the sides and angles of the triangles are shown.

What is the value of *x*?

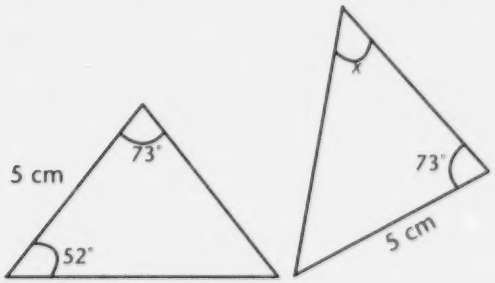
A. 52

B. 55

C. 65

D. 73

E. 75



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Original Item Number: K-8

ITEM 1

A straight line on a graph passes through the points (3, 2) and (4, 4). Which of these points also lies on the line?

A. (1, 1)

B. (2, 4)

C. (5, 6)

D. (6, 3)

E. (6, 5)

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Original Item Number: I-8

EUCLIDEAN UNIFIED SCHOOL DISTRICT

Mathematics Standards for Grades 6–8

GEOMETRY, SPATIAL SENSE, AND MEASUREMENT

Mathematics instructional programs should include attention to geometry, spatial sense, and measurement so that by the end of the eighth grade all students can —

a.) analyze characteristics and properties of two– and three–dimensional geometric objects:

(a1) precisely describe, classify, and compare types of plane and solid figures (e.g., angles, triangles, quadrilaterals, cylinders, cones, etc.) according to their main features;

(a2) analyze and understand geometrical relationships among two-dimensional and three-dimensional figures;

(a3) use proportions to examine relationships between similar plane figures;

(a4) create and critique inductive and deductive arguments concerning geometric ideas and relationships;

(a5) recognize and apply geometric ideas and relationships outside the mathematics classroom, in areas such as art, science, and everyday life.

b.) select and use different representational systems, including coordinate geometry and graph theory:

(b1) learn to use coordinate geometry to display geometric relationships between related quantities, particularly when the relationship is linear;

(b2) use coordinate geometry to represent and examine the properties of geometric figures, especially those containing sets of parallel or perpendicular lines;

(b3) use relationships found in right triangles (e.g., the Pythagorean relation, isosceles right triangles, 30–60–90 degree triangles) to solve problems;

(b4) explore the use of other representational systems, particularly networks.

c.) recognize the usefulness of transformations and symmetry in analyzing mathematical situations:

(c1) describe size, position, and orientation of figures under informal transformations such as flips, turns, slides and magnification;

(c2) use line and rotational symmetry to describe and classify polygons and polyhedra;

(c3) understand the concepts of congruence and similarity using transformations;

(c4) explore the composition of transformations (e.g., successive flips in different lines).

d.) use visualization and spatial reasoning to solve problems both within and outside of mathematics:

(d1) develop fluency with two-dimensional representations of three-dimensional objects;

(d2) compose and decompose two– and three–dimensional figures in order to solve problems;

(d3) use geometric models to represent and explain numerical and algebraic relationships.

e.) understand attributes, units, and systems of measurement:

(e1) select appropriate units and scale to estimate and measure angles, perimeter, area, surface area, and volume;

(e2) understand both metric and customary systems of measurement, including relationships among units of the same system.

f.) apply a variety of techniques, tools, and formulas for determining measurements.

(f1) be proficient in measuring angles in plane figures;

(f2) develop and use formulas for the perimeter and area of parallelograms, trapezoids, circles, and simple composite figures;

(f3) develop and use formulas for the surface area and volume of prisms, pyramids, and cylinders;

(f4) select techniques and tools to measure accurately with levels of precision appropriate to the situation;

(f5) use ratios and proportions to solve problems involving scale factors;

(f6) determine an appropriate scale and use scale drawings or models in applications;

(f7) solve simple problems involving rates and derived measures (e.g., miles per hour).

Adapted from NCTM Principles and Standards for School Mathematics: Discussion Draft (October 1998)

EUCLIDEAN UNIFIED SCHOOL DISTRICT

Mathematics Standards for Grades 6–8

PATTERNS, FUNCTIONS, AND ALGEBRA

Mathematics instructional programs should include attention to patterns, functions, symbols, and models so that by the end of the eighth grade all students can —

a.) understand various types of patterns and functional relationships:

(a1) analyze, create, and generalize numeric and visual patterns paying particular attention to patterns that have a recursive nature;

(a2) use patterns to solve mathematical and applied problems;

(a3) represent a variety of relations and functions with tables, graphs, verbal rules, and, when possible, symbolic rules.

b.) use symbolic forms to represent and analyze mathematical situations and structures:

(b1) develop a sound conceptual understanding of equation and of variable;

(b2) explore relationships between symbolic expressions and graphs, paying particular attention to the horizontal and vertical intercepts, points of intersection, and slope (for linear relations);

(b3) become fluent in generating equivalent expressions for simple algebraic expressions and in solving linear equations and inequalities;

(b4) use symbolic algebra to represent situations and to solve problems, especially those that involve linear relationships.

c.) use mathematical models and analyze change in both real and abstract contexts:

(c1) model and solve contextualized problems using various representations, such as graphs and tables, to understand the purpose and utility of each representation;

(c2) develop an initial understanding of rate of change, with emphasis on the connections among slope of a line, constant rate of change, and their meaning in context;

(c3) explore different types of change occurring in discrete patterns, such as proportional and linear change.

Adapted from NCTM Principles and Standards for School Mathematics: Discussion Draft (October 1998)

WHAT STANDARDS DOES THE ASSESSMENT ADDRESS?

1 Work in small groups.

2 Analyze and "cross-map" each item:

- What mathematics content is addressed?
- Which standard components are addressed?
- How is each component addressed?

3 Record your responses on the colored stickies; post them on the chart.

1. Work in small groups.
2. Carefully consider the "cross-map" matrix.
3. Identify the five items your group would recommend for selection.
4. Prepare to present your choices and rationale to the whole group.

ITEM SELECTION QUESTIONS

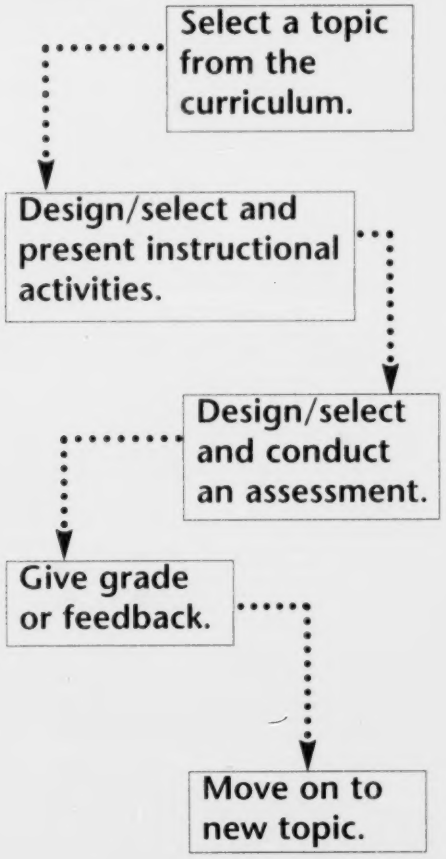
How did the group work to reach its decision?

What criteria did you use?

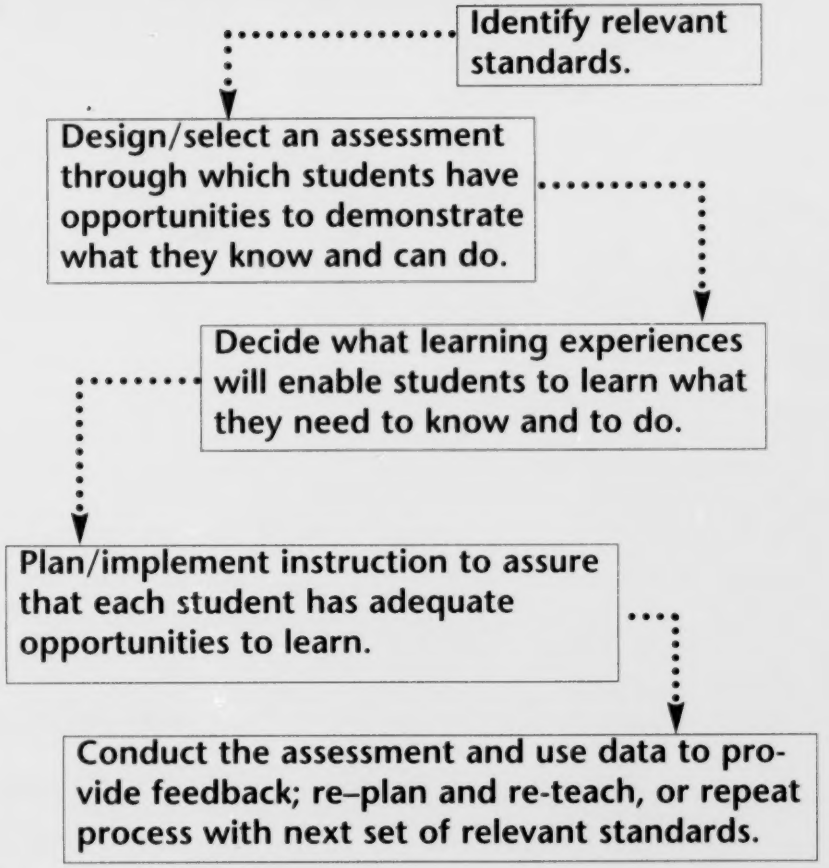
Identify and justify your choices.

THE INSTRUCTIONAL PLANNING PROCESS

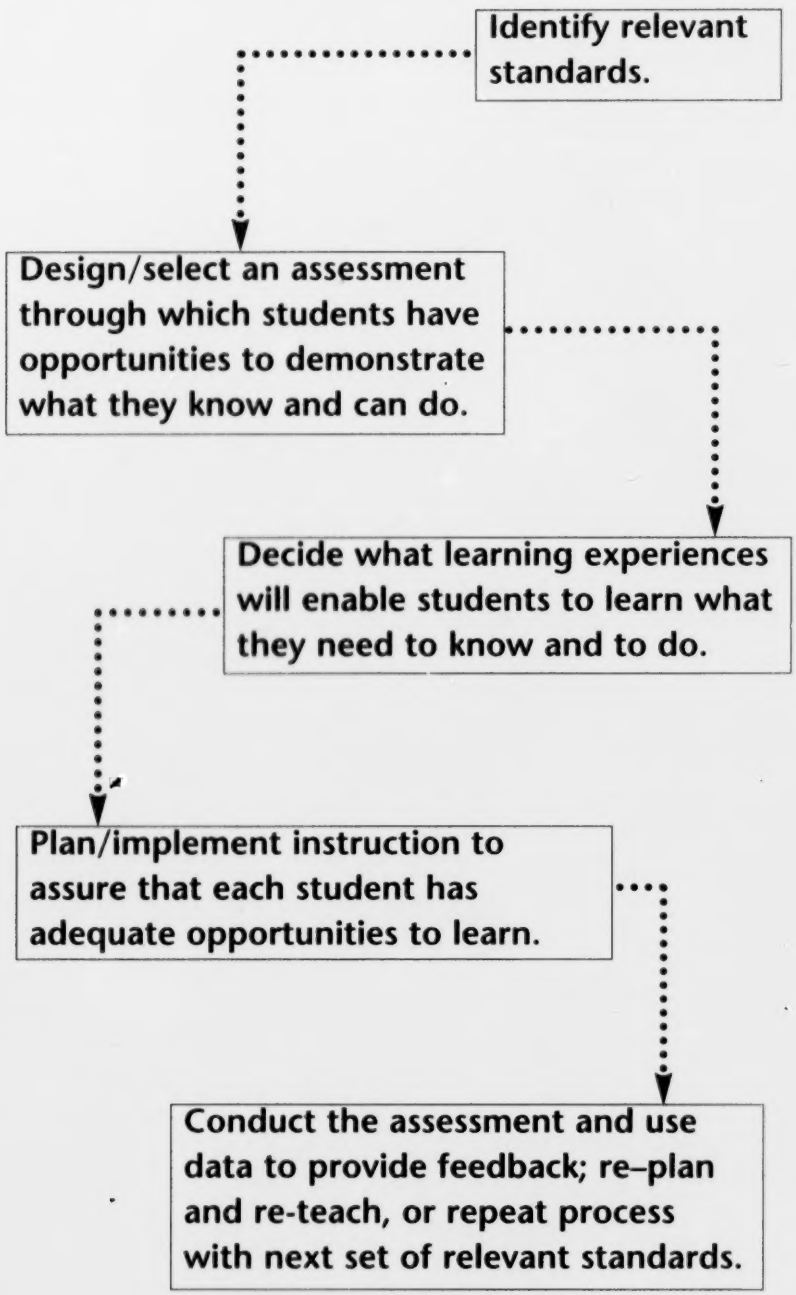
TRADITIONAL practice


Select a topic from the curriculum.
Design/select and present instructional activities.
Design/select and conduct an assessment.
Give grade or feedback.
Move on to new topic.

STANDARDS-BASED practice


Identify relevant standards.
Design/select an assessment through which students have opportunities to demonstrate what they know and can do.
Decide what learning experiences will enable students to learn what they need to know and to do.
Plan/implement instruction to assure that each student has adequate opportunities to learn.
Conduct the assessment and use data to provide feedback; re–plan and re-teach, or repeat process with next set of relevant standards.

STANDARDS-BASED INSTRUCTIONAL PLANNING MODEL


Identify relevant standards.
Design/select an assessment through which students have opportunities to demonstrate what they know and can do.
Decide what learning experiences will enable students to learn what they need to know and to do.
Plan/implement instruction to assure that each student has adequate opportunities to learn.
Conduct the assessment and use data to provide feedback; re–plan and re-teach, or repeat process with next set of relevant standards.

WHAT MATHEMATICAL THINKING WOULD OUR STUDENTS USE ON THE ASSESSMENT?

1 Work with a partner.

2 Do each of the problems.

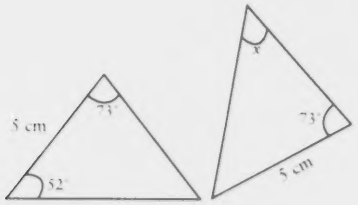
3 Analyze each problem:

- What is being asked in the item?
- What is the mathematical content?

ITEM 3

These triangles are congruent.
The measures of some of the sides and angles of the triangles are shown.

What is the value of x?



A. 52
B. 55
C. 65
D. 73
E. 75

What is the Mathematical Content?

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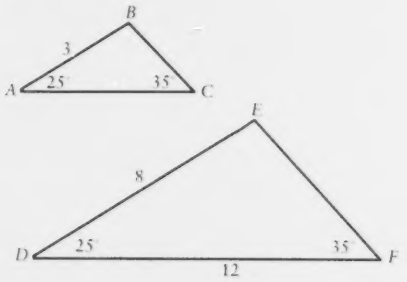
Original Item Number: K-8

ITEM 7

Triangles ABC and DEF are similar triangles.



What is the length of side AC ?

A. 2
B. 4
C. 4.5
D. 5.5
E. 32

What is the Mathematical Content?

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Original Item Number: P-9

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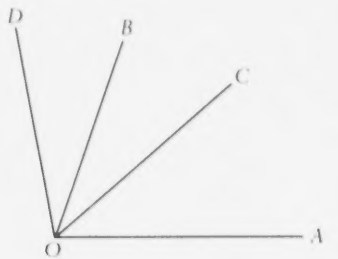
ITEM 14

In the figure, the measure of $\angle AOB$ is 70°, the measure of $\angle COD$ is 60°, and the measure of $\angle AOD$ is 100°.



What is the measure of $\angle COB$?

Answer: _____

What is the Mathematical Content?

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Original Item Number: Q-10

ITEM 17

The figure consists of 5 squares of equal size. The area of the whole figure is 405 cm².

Find the area of one square.

Answer:
_____ square centimeters

Find the length of the side of one square.

Answer:
_____ centimeters

Find the perimeter of the whole figure in centimeters.

Answer:
_____ centimeters

What is the Mathematical Content?

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Original Item Number: S-2a

ITEM 1

A straight line on a graph passes through the points (3, 2) and (4, 4). Which of these points also lies on the line?

A. (1, 1)
B. (2, 4)
C. (5, 6)
D. (6, 3)
E. (6, 5)

What is the Mathematical Content?

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Original Item Number: 1-8

ITEM 2

The table represents a relation between x and y.

What is the missing number in the table?

A. 2
B. 3
C. 4
D. 5
E. 6

x	y
1	1
2	?
4	7
7	13

What is the Mathematical Content?

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Original Item Number: 1-18

ITEM 6

Jan had a bag of marbles. She gave half of them to James and then a third of the marbles still in the bag to Pat. She then had 6 marbles left. How many marbles were in the bag to start with?

A. 18
B. 24
C. 30
D. 36

What is the Mathematical Content?

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Original Item Number: N-16

ITEM 16

Here is a sequence of three similar triangles. All of the small triangles are congruent.

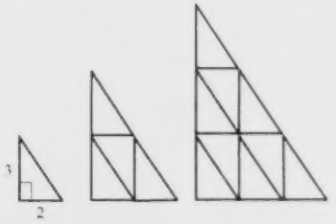

Figure 1 *Figure 2* *Figure 3*

a. Complete the chart by finding how many small triangles make up each figure.

Figure	*Number of small triangles*
1	1
2	?
3	

b. The sequence of similar triangles is extended to the 8th Figure. How many small triangles would be needed for Figure 8?

What is the Mathematical Content?

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Original Item Number: S-1a

HOW DO WE LINK THE ASSESSMENT TO INSTRUCTION?

1. Work in small groups to analyze your assigned item.
2. Define the mathematical content addressed by the item.
3. Determine the student learning experiences required for success.
4. Describe at least two instructional practices (materials, activities, methods) that would best support required student learning experiences.
5. Record your work on the chart paper.
6. Post your charts.

PLANNING INSTRUCTION TO SUPPORT STANDARDS

Worksheet

Standard (or component):

Target Grade(s):

Assessment (items, tasks, etc.):

item	item	item	item	item	item

Key Student Learning Experiences:

Instruction (activities, materials, and methods):

Assessment (for feedback):

GEOMETRY, SPATIAL SENSE AND MEASUREMENT

Mathematics instructional programs should include attention to geometry, spatial sense and measurement so that by the end of the eighth grade all students can –

STANDARD	Item X	Item Y	Item Z
a) analyze characteristics and properties of two- and three-dimensional geometric objects;			
b) select and use different representational systems, including coordinate geometry and graph theory;			
c) recognize the usefulness of transformations and symmetry in analyzing mathematical situations;			
d) use visualization and spatial reasoning to solve problems both within and outside of mathematics.			
e) understand attributes, units, and systems of measurement;			
f) apply a variety of techniques, tools, and formulas for determining measurements.			

PATTERNS, FUNCTION AND ALGEBRA

Mathematics instructional programs should include attention to patterns, functions, symbols and models so that all students can –

STANDARD	Item X	Item Z	Item Y
a) understand various types of patterns and functional relationships:			
a1) analyze, create, and generalize numeric and visual patterns paying particular attention to patterns that have a recursive nature;			
a2) use patterns to solve mathematical and applied problems;			
a3) represent a variety of relations and functions with tables, graphs, verbal rules, and, when possible, symbolic rules.			

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b) use symbolic forms to represent and analyze mathematical situations and structures:			
b1) develop a sound conceptual understanding of equation and variable;			
b2) explore relationships between symbolic expressions and graphs, paying particular attention to the horizontal and vertical intercepts, points of intersection, and slope (for linear relations);			
b3) become fluent in generating equivalent expressions for simple algebraic expressions and in solving linear equations and inequalities;			
b4) use symbolic algebra to represent situations and to solve problems, especially those that involve linear relationships.			

c) use mathematical models and analyze change in both real and abstract contexts:			
c1) model and solve contextualized problems using various representations, such as graphs and tables, to understand the purpose and utility of each representation;			
c2) develop an initial understanding of rate of change, with emphasis on the connections among slope of a line, constant rate of change, and their meaning in context;			
c3) explore different types of change occurring in discrete patterns, such as proportional and linear change.			

SELECTED ASSESSMENT ITEMS

This appendix contains 28 items from large–scale assessments so that you may customize, expand, and extend the *LfA* modules to meet your local needs. The following matrix is included to help you select specific types of items.

Content Categories

G — Geometric Thinking

Geometric figures and their properties, including area, perimeter, and angles; transformations; spatial sense; solving problems using measurements. Analytic geometry.

A — Algebraic Thinking

Reasoning about unknown quantities and their relationships with or without variable notation.

P — Patterns and Functions

Analyzing and recognizing patterns; using patterns and functional relationships to solve problems.

N — Number Sense and Operations

Reasoning about and calculating with integers, decimals, fractions, and percents. Includes proportional reasoning.

D — Data: Analysis and Management

Interpreting and analyzing data in the form of tables and graphs. Probability and statistics.

PS — Problem Solving

Using problem–solving strategies and reasoning to solve problems in a non–routine way.

Item Type

M — Multiple choice
S — Short answer
E — Extended response

Item Source

T — *Third International Mathematic and Science Study (TIMSS)*
N — *National Assessment of Educational Progress (NAEP)*
B — *Balanced Assessment Project*
NS — *New Standards Project*

SELECTED ASSESSMENT ITEM MATRIX

ITEMS			CONTENT CATEGORIES						NOTES
Number	Type	Source	G	A	P	N	D	PS	
1	M	T	•	•	•				
2	M	T		•	•	•			
3	M	T	•						
4	M	T			•	•		•	
5	M	T	•	•					
6	M	T		•		•			
7	M	T	•			•			
8	M	T		•					
9	M	T	•						
10	M	N		•					
11	S	T			•	•		•	
12	S	T	•	•					
13	S	T		•		•			
14	S	T	•	•				•	
15	S	T		•		•			
16	S	T	•		•	•		•	
17	S	T	•	•				•	
18	S	T		•					
19	S	T	•			•		•	
20	S	T	•			•			
21	S	N	•		•				
22	S	N		•	•	•		•	
23	E	N	•					•	
24	E	N				•	•	•	
25	E	N					•		
26	E	B	•	•				•	
27	E	B				•	•	•	
28	E	NS				•	•	•	

ITEM 1

A straight line on a graph passes through the points (3, 2) and (4, 4). Which of these points also lies on the line?

A. (1, 1)

B. (2, 4)

C. (5, 6)

D. (6, 3)

E. (6, 5)

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Original Item Number: I-8

ITEM 2

The table represents a relation between x and y.

What is the missing number in the table?

A. 2

B. 3

C. 4

D. 5

E. 6

x	y
1	1
2	?
4	7
7	13

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Original Item Number: J-18

ITEM 3

These triangles are congruent. The measures of some of the sides and angles of the triangles are shown.

What is the value of x?

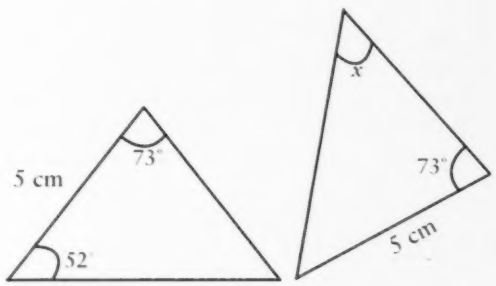
A. 52

B. 55

C. 65

D. 73

E. 75



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Original Item Number: K-8

ITEM 4

A rubber ball rebounds to half the height it drops. If the ball is dropped from a rooftop 18 m above the ground, what is the total distance traveled by the time it hits the ground the third time?

A. 31.5 m

B. 40.5 m

C. 45 m

D. 63 m

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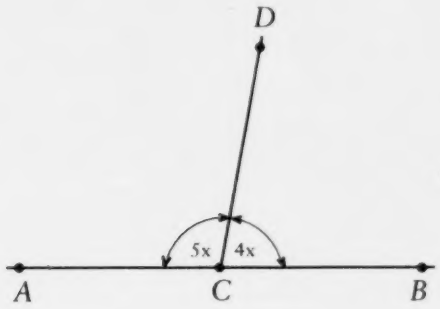
Original Item Number: L-11

ITEM 5

In this figure *AB* is a straight line.



What is the measure, in degrees, of angle *BCD* ?

A. 20

B. 40

C. 50

D. 80

E. 100

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Original Item Number: M-7

ITEM 6

Jan had a bag of marbles. She gave half of them to James and then a third of the marbles still in the bag to Pat. She then had 6 marbles left. How many marbles were in the bag to start with?

A. 18

B. 24

C. 30

D. 36

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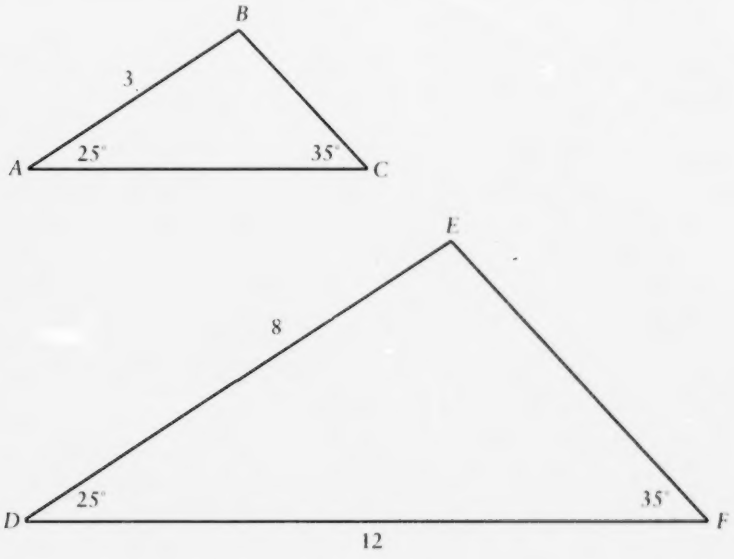
Original Item Number: N-16

ITEM 7

Triangles *ABC* and *DEF* are similar triangles.



What is the length of side *AC*?

A. 2

B. 4

C. 4.5

D. 5.5

E. 32

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Original Item Number: P-9

ITEM 8

Juan has 5 fewer hats than Maria, and Clarissa has 3 times as many hats as Juan. If Maria has n hats, which of these represents the number of hats that Clarissa has?

A. $5 - 3n$

B. $3n$

C. $n - 5$

D. $3n - 5$

E. $3(n - 5)$

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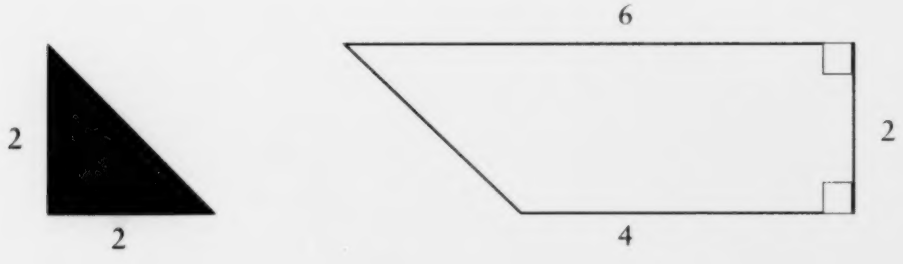
Original Item Number: Q-1

ITEM 9

How many triangles of the shape and size of the shaded triangle can the trapezoid below be divided into?



A. Three

B. Four

C. Five

D. Six

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Original Item Number: R-10

ITEM 10

Which of the following ordered pairs (x, y) is a solution to the equation $2x - 3y = 6$?

A. (6, 3)

B. (3, 0)

C. (3, 2)

D. (2, 3)

E. (0, 3)

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996, Grade 8 Mathematics
Original Item Number: Block S2M3, Item 8

ITEM 11

The numbers in the sequence 2, 7, 12, 17, 22, ... increase by fives. The numbers in the sequence 3, 10, 17, 24, 31, ... increase by sevens. The number 17 occurs in both sequences. If the two sequences are continued, what is the next number that will be seen in both sequences?

Answer: _____

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Original Item Number: I-4

ITEM 12

The length of a rectangle is 6 cm, and its perimeter is 16 cm. What is the area of the rectangle in square centimeters?

Answer: _____

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Original Item Number: K-5

ITEM 13

A class has 28 students. The ratio of girls to boys is 4 : 3. How many girls are in the class?

Answer: _____

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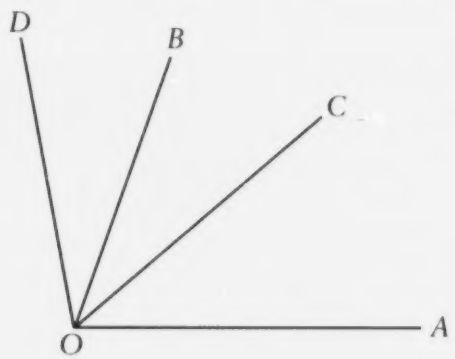
Original Item Number: M-6

ITEM 14

In the figure, the measure of $\angle AOB$ is 70°, the measure of $\angle COD$ is 60°, and the measure of $\angle AOD$ is 100°.



What is the measure of $\angle COB$?

Answer: _____

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Original Item Number: Q-10

ITEM 15

Peter bought 70 items and Sue bought 90 items. Each item cost the same and the items cost $800 altogether. How much did Sue pay?

Answer: Sue paid _____

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Original Item Number: R-14

ITEM 16

Here is a sequence of three similar triangles. All of the small triangles are congruent.

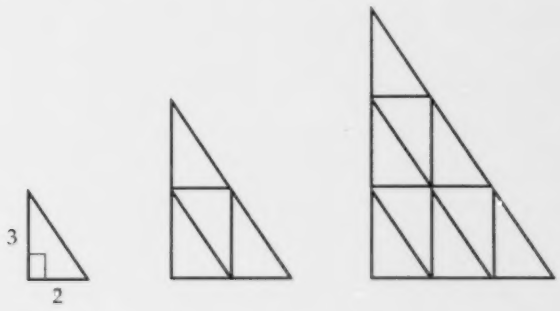

Figure 1 *Figure 2* *Figure 3*

a. Complete the chart by finding how many small triangles make up each figure.

Figure	*Number of small triangles*
1	1
2	
3	

b. The sequence of similar triangles is extended to the 8th Figure. How many small triangles would be needed for Figure 8?

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Original Item Number: S-1a

ITEM 17

The figure consists of 5 squares of equal size. The area of the whole figure is 405 cm^2.

Find the area of one square.

Answer _____ square centimeters

Find the length of the side of one square.

Answer _____ centimeters

Find the perimeter of the whole figure in centimeters.

Answer _____ centimeters

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Original Item Number: S-2a

ITEM 18

There are 54 kilograms of apples in two boxes. The second box of apples weighs 12 kilograms more than the first. How many kilograms of apples are in each box? Show your work.

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Original Item Number: T-1a

ITEM 19

Two boxes of square-shaped cardboard pieces are available to make a larger pattern. There are 4 small squares in each piece.

All pieces in Box 1 look like

All pieces in Box 2 look like

In the required pattern, for every piece from Box 2 there are 2 pieces from Box 1.

a. If 60 pieces from Box 2 are used in the required pattern, how many pieces will be needed altogether?

Answer: _____

b. What fraction of the small squares in the required pattern will be black?

Answer: _____

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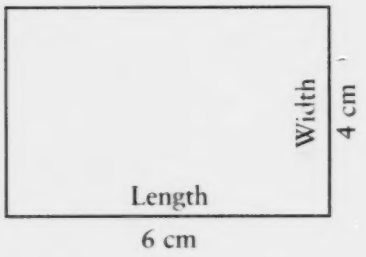
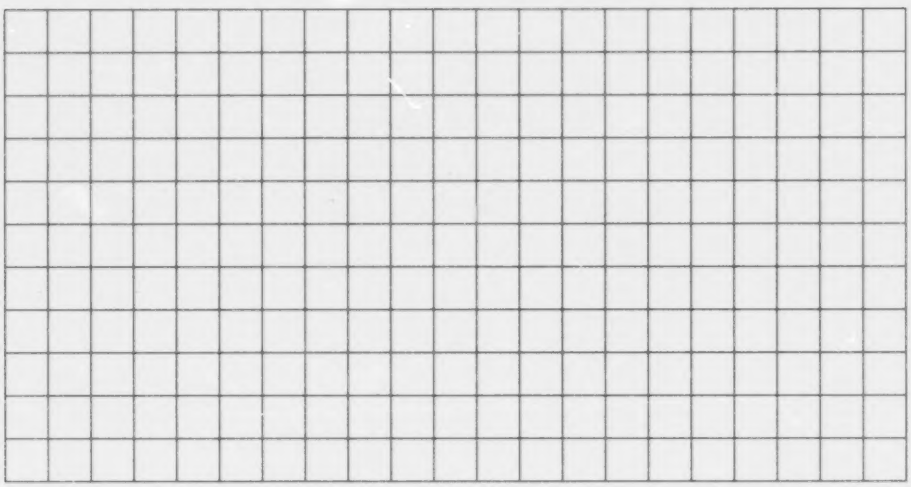
Original Item Number: T-2a

ITEM 20



a. In the space below, draw a new rectangle whose length is one and a half times the length of the rectangle above, and whose width is half the width of the rectangle above. Show the length and width of the new rectangle in centimeters on the figure.



b. What is the ratio of the area of the new rectangle to the area of the first one? Show your work.

ITEM 21

From any vertex of a 4-sided polygon, 1 diagonal can be drawn.
From any vertex of a 5-sided polygon, 2 diagonals can be drawn.
From any vertex of a 6-sided polygon, 3 diagonals can be drawn.
From any vertex of a 7-sided polygon, 4 diagonals can be drawn.

How many diagonals can be drawn from any vertex of a 20-sided polygon?

Answer: _____

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996, Grade 8 Mathematics
Original Item Number: Block S2M3, Item 10

ITEM 22

If x and y are integers, then the expression $4x + 5y$ has a value that is odd or even depending on the values of x and y. For example, if x and y are each even, $4x$ is even and $5y$ is even. Therefore, $4x + 5y$ is also even. Fill in each of the blank spaces in the following table with either "odd" or "even".

Value of x	*Value of y*	*Value of 4x + 5y*
even	even	even
even	odd	
odd	even	
odd	odd	

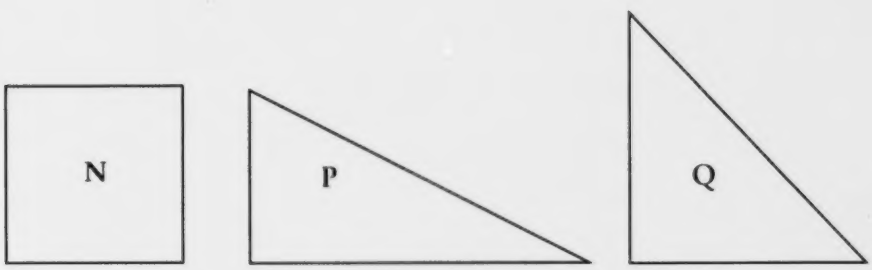
SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996, Grade 8 Mathematics
Original Item Number: Block S123M10C, Item 7

ITEM 23

Bob, Carmen, and Tyler were comparing the areas of *N* and *P*. Bob said that *N* and *P* have the same area. Carmen said that the area of *N* is larger. Tyler said that the area of *P* is larger.

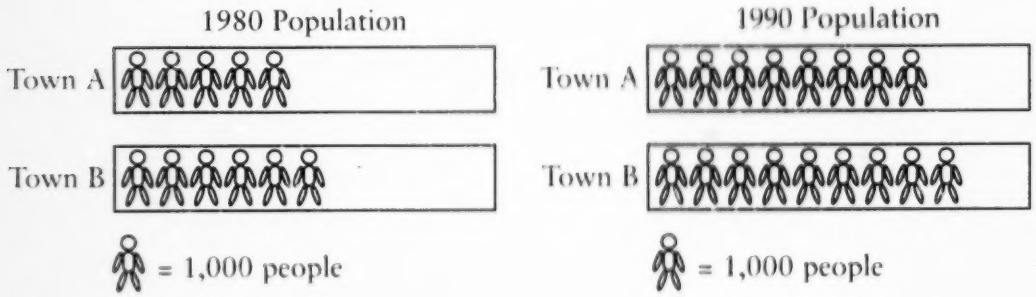
Who was correct? _____

Use words or pictures (or both) to explain why.



SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996, Grade 8 Mathematics
Original Item Number: Block S123M10B, Item 5

ITEM 24



In 1980, the populations of Town A and Town B were 5,000 and 6,000, respectively. The 1990 population of Town A and Town B were 8,000 and 9,000, respectively.

Brian claims that from 1980 to 1990 the populations of the two towns grew by the same amount. Use mathematics to explain how Brian might have justified his claim.

Darlene claims that from 1980 to 1990 the population of Town A had grown more. Use mathematics to explain how Darlene might have justified her claim.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996, Grade 8 Mathematics
Original Item Number: Block S123M10B, Item 5

ITEM 25

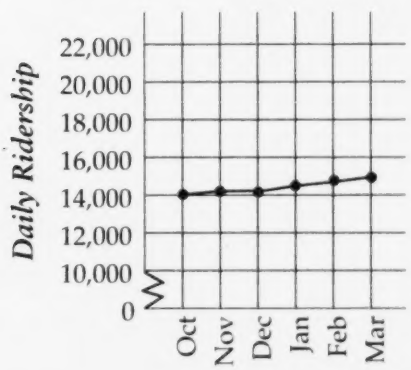
This question requires you to show your work and explain your reasoning. You may use drawings, words, and numbers in your explanation. Your answer should be clear enough so that another person could read it and understand your thinking. It is important that you show all of your work.

METRO RAIL COMPANY

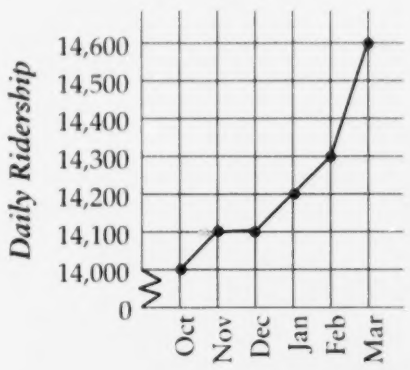
Month	*Daily Ridership*
October	14,000
November	14,100
December	14,100
January	14,200
February	14,300
March	14,600

The data in the table above has been correctly represented by both graphs shown below.

Graph A



Graph B



SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996, Grade 8 Mathematics
Original Item Number: Block S123M10B, Item 9

Item 25 continues on next page.

Which graph would be best to help convince others that the Metro Rail Company made a lot more money from ticket sales in March than in October?

Explain your reason for making this selection.

Why might people who thought that there was little difference between October and March ticket sales consider the graph you chose to be misleading?

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996, Grade 8 Mathematics
Original Item Number: Block S123M10B, Item 9

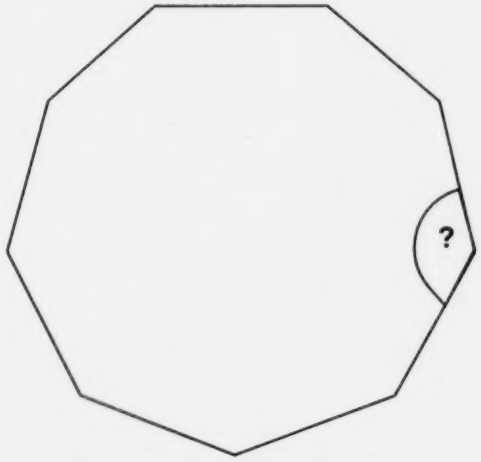
ITEM 26

The aim of this assessment is to provide the opportunity for you to:
- find angle measurements
- find perimeter and area of figures
- compare regular polygons

Designers are experimenting with new tile shapes for walls and floors.

- The tile here is in the shape of a regular *nonagon.*

- The regular *nonagon* has nine equal sides and angles.



1. What is the measure of the angle marked in the figure? _____
   (Use any measuring tool that will help you.)

2. Estimate as good as you can the area of the nonagon: _____
   Describe how you got your answer.

3. Estimate as good as you can the perimeter of the nonagon: _____
   Describe how you got the answer.

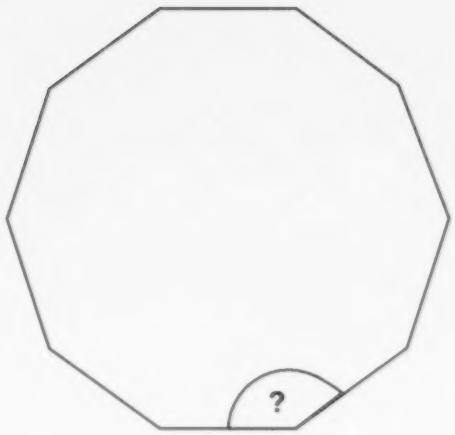
4. Will nonagons make good tiles for floors and walls because they fit together with no gaps? Use the geometric properties of the nonagon to explain or illustrate why.

SOURCE: Balanced Assessment Task 4100

Item 26 continues on next page.

Designers have developed another tile shape:

- The tile here is in the shape of a regular *decagon.*
- The sides of this *decagon* are the same length as those of the *nonagon.*



5. Without using any measuring tools, decide whether the angle marked in this decagon is larger or smaller than the angle marked in the nonagon. Explain why this is so.

6. Is the perimeter of the decagon greater, smaller or the same as the nonagon? Explain how you know.

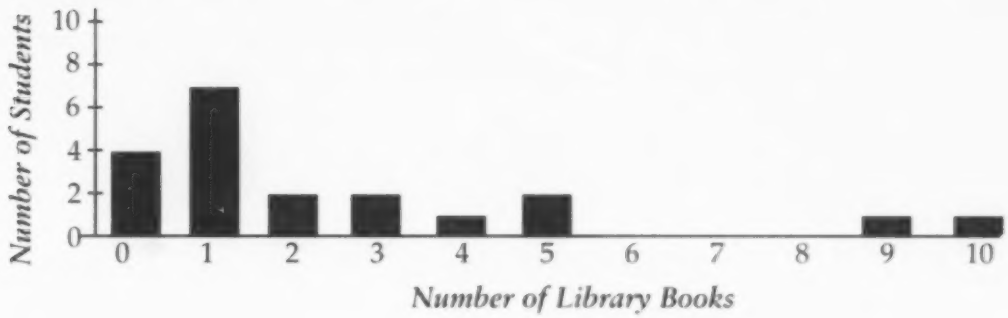
7. Is the area of the decagon greater, smaller or the same as the nonagon on the previous page? Explain your reasoning.

SOURCE: Balanced Assessment Task 4100

ITEM 27

The aim of this assessment is to provide the opportunity for you to:
- use knowledge of statistics to analyze and interpret data in graph
- justify choice of measure center

Nigel made a graph showing how many books were taken from the library by students in his class in the last week. (See below.)



1. How many books have been taken out of the library by Nigel's class? Show how you got your answer.

2. Erik and Julie are the only students in the class who have started working on a big report. How many books do you think that Erik and Julie have each checked out?

   Erik: _____ Julie: _____

   Explain your reasoning.

Item 27 continues on next page.

SOURCE: Balanced Assessment Task 4110

3. Nigel said, "The mean number of library books that student have is 2.5."
Julie said, "The median number of library books that student have is 1!"
Ms. Estaphan said, "You are both correct!"
Why are these two averages different?

4. Which average would you choose to tell what is the typical number of books checked out by the students? Explain why.

SOURCE: Balanced Assessment Task 4110

ITEM 28

Benefit Concert *(about 15 minutes)*

Below is information about four concert acts:

Act	*number of shows in tour*	*% of available seats filled for tour*	*total audience attendance for tour*	*dollar amount from tickets sold for tour*	*average ticket price*
Act W	105	80%	1,274,654	$26,130,407	$20.50
Act X	78	70%	886,516	$21,498,013	$24.25
Act Y	120	90%	1,019,038	$19,361,722	$19.00
Act Z	71	80%	648,895	$12,653,453	$19.50

These four acts each offered to give a benefit performance to celebrate the completion of the City Center Auditorium. Each act would charge its average ticket price. The city's auditorium holds 10,000 people. The city council must choose just one of these four acts for the benefit.

Based on the data, write a recommendation to the city council, advising them which act you expect will raise the most money. Use mathematics to support your recommendation.

SOURCE: New Standards

INSTRUCTIONS FOR ASSEMBLING THE **LEARNING FROM ASSESSMENT: TOOLS FOR EXAMINING ASSESSMENT THROUGH STANDARDS** KIT

Tabbed Divider Title	*Where to Insert*
Title Page	☛ at front
Professional Development Sessions	☛ after page 8
Module 1: Aligning Assessment to Standards	☛ after "Professional Development Sessions" tab divider
Module 2: Collecting Standards–based Evidence	☛ after page 1–17
Module 3: Planning Instruction to Support Standards	☛ after page 2–24
Facilitator Support	☛ after page 3–21
Facilitator Support: Planning Tools	☛ after "Facilitator Support" tab divider
Facilitator Support: Supplementary Activities	☛ after page FS–10
Facilitator Support: Selected References	☛ after page FS–26
Appendices	☛ after page FS–32
Appendix A: Transparencies and Handouts	☛ after "Appendices" tab divider
Appendix B: Selected Assessment Items	☛ after BLM–36c

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